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# GASTROENTEROLOGY

## ABSTRACTS AND CITATIONS

NATIONAL INSTITUTE OF ARTHRITIS, METABOLISM, AND DIGESTIVE DISEASES

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## PREFACE

GASTROENTEROLOGY ABSTRACTS and CITATIONS is a publication of the National Institute of Arthritis, Metabolism and Digestive Diseases. This specialized information medium has been initiated to fill an existing great need in the field of gastroenterology and to assist the Institute in meeting its obligations to foster and support laboratory and clinical research into the nature, causes, and therapy of diseases of the gastrointestinal tract. Publication GASTROENTEROLOGY ABSTRACTS and CITATIONS makes available citations of all current papers relevant to this field from medical journals published throughout the world. Approximately one-third of the citations dealing with the major aspects of gastroenterology have accompanying abstracts.

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## NOTE

Journal names are abbreviated according to the list of abbreviations used by *Index Medicus*. For journals not covered by *Index Medicus*, the abbreviations (with some modifications) found in *World Medical Periodicals*, 3rd Edition, are used.

## LANGUAGE ABBREVIATIONS

| | | | |
|---|---|---|---|
| Afr. | Afrikaans | It. | Italian |
| Ar. | Arabic | Jap. | Japanese |
| Bul. | Bulgarian | Kor. | Korean |
| Ch. | Chinese | Latv. | Latvian |
| Cz. | Czech | Lith. | Lithuanian |
| Dan. | Danish | Nor. | Norwegian |
| Dut. | Dutch | Pol. | Polish |
| E. | English | Por. | Portuguese |
| Eston. | Estonian | Rum. | Rumanian |
| Fin. | Finnish | Rus. | Russian |
| Fl. | Flemish | Ser. | Serbo-Croatian |
| Fr. | French | Sl. | Slovak |
| Ger. | German | Sp. | Spanish |
| Gr. | Greek | Sw. | Swedish |
| Heb. | Hebrew | Th. | Thai |
| Hun. | Hungarian | Turk. | Turkish |
| Ic. | Icelandic | Uk. | Ukrainian |
| In. | Indonesian | Viet. | Vietnamese |

## ABBREVIATIONS USED IN ABSTRACTS

| | | | |
|---|---|---|---|
| ACTH | adrenocorticotropic hormone | mm | millimeter(s) |
| ADP | adenosine diphosphate | mOsm | milliosmolar; milliosmeter(s) |
| AMP | adenosine monophosphate | msec | millisecond(s) |
| amp | ampere | mV | millivolt(s) |
| ATP | adenosine triphosphate | min | minute(s) |
| Å | angstrom | MTD | maximum tolerated dose |
| BSP | sulfobromophthalein | NAD | nicotanamide adenine dinucleotide |
| C | degrees centigrade | NADH | reduced nicotanamide adenine dinucleotide |
| cal | calories | | |
| cc | cubic centimeter | NADP | nicotanamide adenine dinucleotidephosphate |
| cm | centimeter(s) | | |
| dl | deciliter | NAPH | reduced nicotanamide adenine dinucleotidephosphate |
| DNA | deoxyribonucleic acid | | |
| $ED_{50}$ | median effective dose(s) | ng | nanogram ($10^{-9}$) |
| EDTA | ethylenediamine tetraacetic acid | nm | nanometer(s) |
| e.g. | for example | Pa | ambient pressure |
| EEG | electroencephalogram | PAS | periodic acid — Schiff |
| ESR | erythrocyte sedimentation rate | pg | picogram ($10^{-12}$) |
| g | gram(s) | pgEq | picogram equivalent(s) |
| µg | microgram(s) | p.o. | orally |
| Hz | Herz | ppb | parts per billion |
| hr | hour(s) | ppm | parts per million |
| i.m. | intramuscular | r | Roentgen |
| i.p. | intraperitoneal | RBC | red blood cells (erythrocytes), red blood count |
| IU | international unit(s) | | |
| i.v. | intravenous | resp. | respectively |
| kcal | kilocalorie(s) | RNA | ribonucleic acid |
| kg | kilogram(s) | s.c. | subcutaneous |
| $K_m$ | Michaelis constant | sec | second(s) |
| $LD_{50}$ | median lethal dose(s) | SGOT | serum glutamic-oxalacetic transaminase |
| LDH | lactic acid dehydrogenase | | |
| m | meter(s) | SGPT | serum glutamic-pyruvic transaminase |
| M | molar; mole(s) | | |
| mM | millimolar; millimole(s) | U | unit(s) |
| µM | micromolar; micromole(s) | UV | ultraviolet |
| ma | milliampere(s) | V | volt |
| mCi, µCi | milli-, microcurie(s) | WBC | white blood cells (leukocytes), white blood count |
| mEq | milliequivalent(s) | | |
| mg | milligram(s) | yr | year(s) |
| ml, µl | milli-, microliter(s) | | |

# PRE-CLINICAL SCIENCES

## MORPHOLOGY, CELLULAR STRUCTURE AND HISTOCHEMISTRY

6594 ENDOCRINE CELLS OF THE INTESTINAL MUCOSA. II. NON-ARGENTAFFIN CELLS. *(Pol.)* Lamprecht, J. (Inst. Cell Pathophysiol., CMKP, Warsaw, Poland). *Patol. Pol.* 25(4):595-602, 1974.

Identification and characterization of endocrine cells (EC) of the intestinal mucosa, as well as their functional correlation with intestinal hormones presumably generated by them, was studied directly by electron microscopy and indirectly from other sources. The group of cells in question, morphologically and functionally different from other types of endocrine cells of the intestinal mucosa (especially those of EC cells), designated as nonargentaffin cells, include at least seven individual types of endocrine cells identified by electron microscopy (by the author), or by some other methods (by other researchers): type S (found mostly in duodenum); type EG (in rectum); type I (in duodenum); D (in stomach); $D_1$ (in duodenum); A-like (in stomach); and T (in duodenum). So far, only two different hormones could be associated with certainty with individual types of nonargentaffin cells as their sources of generation: secretin--with cell type S; and enteroglucagon--with cell type EG. To pursue further the investigation of correlation between specific nonargentaffin cells and individual intestinal hormones, the author recommends the intensification of immunological studies at the electron-microscopic level.

6595 AN UNUSUAL MODIFICATION OF ENDOPLASMIC RETICULUM IN EPITHELIAL CELLS OF THE MOUSE ASCENDING COLON. *(E.)* Michaels, J. E. (Dep. Anatomy, McGill Univ., Montreal, Quebec, Canada). *Anat. Rec.* 183(1):27-38, 1975.

A rarely occurring modification of the endoplasmic reticulum in the epithelium of the ascending colon of the mouse was studied in outbred adult male CD-1 animals. The mice were perfused through the descending thoracic aorta with fixative, after which the colonic tissue was sectioned and observed under a Siemens Elmiskop 1A microscope. The modified endoplasmic reticulum consisted of a stack of 3 to 15 parallel cisterna-like elements separated by regular intervals of about 67 nm. The stacked cisternae were usually located adjacent to the basal end of the nucleus or in the region between the nucleus and the basal cell membrane. The top and bottom cisternae of many of of the stacks had patent lumens and their outer membranes were lined by ribosomes. Although the middle cisternae most frequently had attenuated lumens in their central regions, in some instances the width of the cisternal lumens was similar throughout. Closely apposed pairs of cisternae were also observed, and some of the stacks had a concentric configuration. The intercisternal space contained tightly packed vesicles about 38 nm in diameter which were arranged in a hexagonal pattern. Many of the vesicles were connected to the membranes of the cisternae by stalk-like projections, but the vesicles also occurred between the nuclear envelope and the adjacent parallel cisternae. Mitochondria were situated close to each stack. The vesiculated stacked cisternae appeared to be distinct from the annulate lamellae in several respects, although it is likely that some of the previously reported neuronal lamellar structures are closely related or identical to the vesiculated stacked cisternae. It is highly unlikely that these cisternae are mere artifacts despite their infrequent occurrence.

6596 IMMUNOCHEMICAL STUDIES OF THE ENDOCRINE CELLS OF THE GASTROINTESTINAL TRACT. I. THE USE AND VALUE OF PEROXIDASE-CONJUGATED ANTIBODY TECHNIQUES FOR THE LOCALIZATION OF GASTRIN-CONTAINING CELLS IN THE HUMAN PYLORIC ANTRUM. *(E.)* Robinson, G.; Dawson, I. (Dept. Pathology, Univ. Nottingham, England). *Histochem. J.* 7(4):321-333, 1975.

Light microscopic and immunochemical localization of gastrin-containing cells in cryostat sections of human pyloric antrum were reported. Parallel electron microscope studies were also carried out. Specimens of grossly normal antral mucosa were obtained from patients after pyloroplasty for duodenal ulcer or gastrectomy. All samples were either fresh-frozen or pre-fixed in 4% formaldehyde. The immunological reagents included: rabbit anti-human gastrin serum, glutaraldehyde-activated horseradish peroxidase and peroxidase-conjugated swine anti-rabbit IgG. Cryostat sections were single- or double-stained using direct or indirect techniques. No gastrin-containing cells were localized in fresh-frozen, postfixed tissue, or in unfixed fresh-frozen sections. Staining of sections from paraformaldehyde-fixed blocks by direct and indirect single stain methods using 3,3'-diaminobenzidine tetrahydrochloride (DAB) as a substrate showed the presence of gastrin-containing cells in the antral mucosal glands. Many cells containing either endogenous peroxidase or heme derivatives were also intensely stained by DAB. Preincubation of sections in 0.1 M sodium azide, potassium cyanide, sodium nitroferrocyanide or 3-amino-1,2,4-triazole inhibited endogenous peroxidase activity in the cytoplasmic components of antral mucosal cells, but the macrophages, neutrophils, eosinophils and erythrocytes still stained after DAB treatment. Gastrin-containing cells in prefixed cryostat sections were also demonstrated by both the direct and indirect double-staining techniques. These cells stained a different color from those containing endogeneous peroxidase or substances giving a pseudoperoxidase reaction. No gastrin-containing cells were stained in control sections. The distribution and variation in shape exhibited by the gastrin-containing cells localized by these immunoperoxidase methods were similar to those previously found using immunofluorescent techniques. The methods used in this study, providing a permanent preparation which can be examined under normal bright field illumination, are suggested as useful alternatives to fluorescent methods.

6597 CELL POPULATION KINETICS IN THE MOUSE JEJUNAL CRYPT. *(Eng.)* Al-Dewachi, H. S.; Wright, N. A.; Appleton, D. R.; Watson, A. J. (Dept. Pathology and Medical Statistics, Univ. Newcastle upon Tyne, Newcastle upon Tyne, NE1 4LP, England). *Virchows Arch. [Zellpathol.]* 18(3):225-242, 1975.

Kinetics of jejunal crypt cells were studied in 3-mo-old male Balb/c mice using tritiated thymidine ($^3$HTdR) labeling techniques in association with stathmokinetic studies with vincristine. Time parameters were determined by FLM experiment; 49 mice were injected i.p. with $^3$HTdR, 1 μCi/g, and were killed thereafter. The mean cell cycle time ($T_c$) was 12.42 hr and the duration of DNA synthesis was 7.61 hr. A $T_c$ of 11.9 hr was observed with a stathmokinetic technique using vincristine. The growth fraction, 0.61, calculated from cycle parameters and from the labeling index was compared to a value of 0.65 estimated from a labeling distribution curve. The mitotic duration was found to vary with cell population. The duration of mitosis for a whole crypt was 0.86 hr, between 0.8 and 1.2 hr for the proliferative compartment and somewhat shorter for basal cell positions. Apparent $T_c$ were longest in the basal cell positions. The crypt migration rate, calculated from a cumulative birth rate curve, was 1.48 cell positions/hr, compared with 1.8 cell positions/hr as measured from movement of the 50% peak value on the labeling index distribution curve with time after $^3$HTdr treatment. The crypt cell production rate, calculated from microdissected, squashed crypts, was 14 cells/crypt/hr. The total crypt population was 282 cells, of which 175 were proliferative. In some instances, the experimental results were compared with values previously published for mouse jejunal crypt cells.

6598 CELL POPULATION KINETICS IN THE RAT JEJUNAL CRYPT. *(Eng.)* Wright, N. A.; Al-Dewachi, H. S.; Appleton, D. R.; Watson, A. J. (Dept. Pathology and Medical Statistics, Univ. Newcastle upon Tyne, Newcastle upon Tyne, England). *Cell Tissue Kinet.* 8(4):361-368, 1975.

Autoradiographic techniques with tritiated thymidine (i.p. injection of 0.5 μCi/g) and a stathmokinetic technique with vincristine were employed to study the cell kinetics (including crypt cell production rate) in the jejunal crypt of 3-mo-old male Wistar rats. The migration rate of the 50% peak on the labeling index distribution curve 9 hr after administration of tritiated thymidine was 1.43 cell positions/hr. This was compared with the maximum value reached from a cumulative birth rate curve of 1.78 positions/hr. The product of the mean number of cells in the crypt column, 32.9, and in the column count (measurement made by counting ≅ 100 circular crypt cross sections), 22.3, gave an estimate of the total crypt population of 734 cells/crypt, compared with 650 estimated from direct observation of squashed, microdissected crypts. The mean number of mitoses/crypt was 22.5. The crypt cell production rate was 32 cells/hr; this value was confirmed by two independent techniques. The crypt growth fraction, calculated from the duration of phases of the cell cycle and the labeling index, was 0.62 compared to 0.61 found from the labeling index distribution curve. As assessed from crypt squashes, there were 402 proliferating cells/crypt.

6599 CELL SURFACE IMMUNOGLOBULIN. XIV. SYNTHESIS, SURFACE EXPRESSION, AND SECRETION OF IMMUNOGLOBULIN BY PEYER'S PATCH CELLS IN THE MOUSE. *(E.)* Vitetta, E. S.; McWilliams, M.; Phillips-Quagliata, J. M.; Lamm, M. E.; Uhr, J. W. (Univ. Texas Southwestern Medical Sch., Dallas, Texas 75235). *J. Immunol.* 115(2):603-605, 1975.

Peyer's patch cells were studied to determine whether presence of a δ-chain accounted for heavy-chain deficits (surface and intracellular) observed by immunofluorescence. Peyer's patches from BALB/c mice were radioiodinated and cultured *in vitro* with $^3$H-leucine. Cells and medium were separated by centrifugation. The cells were lysed and the lysates dialyzed. Both lysates and secretions were centrifuged and the supernatants treated with rabbit anti-μ, anti-α, and anti-γ, polyvalent anti-Ig (μ, γ, α, κ, λ) or rabbit anti-bacteriophage ϕ x 174 (anti-ϕx) (control) and goat anti-rabbit Ig. Precipitates were subjected to electrophoresis. Neither IgG nor IgA was detected on the cell surface. In five experiments IgM constituted 5-15% of the total surface Ig. The most prominent heavy chain, precipitated by polyvalent serum only, had an approximate molecular weight of 68,000. Like the human δ-chain it was prevalent on the cell surface but not in the serum, was susceptible to proteolysis, was about 15% carbohydrate, and did not react with μ, γ, or α. In addition, both the δ-chain and the prominant heavy chain had similar molecular weights of both the assembled molecules and the intact heavy-chain. IgD constituted 85-95% of the total labeled Ig on the cell surface. An additional peak of molecular weight 40-45,000 was precipitated by most antisera and the control. Electrophoresis of the cell secretions showed identical patterns to those of the cell lysates. The δ- and μ-chain peaks were sharp, but the α-chain was heterogeneous. Anti-Ig precipitated an additional heavy chain peak of about 48,000 m.w. Labeling failed to yield a heavy chain with a molecular weight corresponding to that of an intact δ-chain. It is concluded that the δ-chains probably account for the heavy chain deficit on Peyer's patch cells.

6600 CHOLINERGIC INNERVATION OF THE GASTRIC WALL OF THE CAT. *(E.)* Kyosola, K.; Veijola, L.; Rechardt, L. (Dept. Anatomy, Univ. Helsinki, Finland). *Histochemistry* 44(1):23-30, 1975.

Morphologic patterns in the intrinsic cholinergic innervation of the gastric wall of the cat were studied. Sections of gastric wall were excised from anesthetized cats. Tissue was subjected to immersion fixation, perfusion fixation, or perfusion and subsequent immersion. Cholinesterases were demonstrated by one of two thiocholine techniques: Gomori's modification of the Koelle-Friedenwald technique or the direct-coloring copper-ferrocyanide method. Acetylcholinesterase-positive nerve fibers or small fascicles were observed in the muscularis externa of

the pyloric region, running parallel to the stomach wall. A wide-meshed acetylcholinesterase-positive nerve network with large submucosal ganglia was observed in the serosa and in the subserosa. The general pattern of organization of the intrinsic cholinergic nervous apparatus of the fundic region was similar to that observed for the pyloric region. Duodenal tissue samples (controls) had acetylcholinesterase activity mainly confined to nerves in all layers of the duodenal wall. All smooth muscle layers of the gastric wall showed some degree of activity of the nonspecific cholinesterases; activity was most intense in the muscularis mucosae, moderate in the longitudinal muscle layer, and relatively weak in the circular muscle layer. It is concluded that the distribution of cholinesterase activity found indicates that the intrinsic cholinergic neural control concerns both the motor and secretory functions of the gastric mucosa.

6601 VEGETATIVE INNERVATION OF THE ESOPHAGUS. III. INTRAEPITHELIAL ENDINGS. *(Eng.)* Rodrigo, J.; Hernández, C. J.; Vidal, M. A.; Pedrosa, J. A. (Instituto Cajal, CSIC, C/Velázquez 144, Madrid 6, Spain). *Acta Anat. (Basel)* 92(2):242-258, 1975.

The vegetative innervation of the esophagus was studied in ten cats and three rhesus monkeys, with particular attention to the existence and morphology of the intraepithelial nerve endings. The esophagi were impregnated using the osmium tetroxide-zinc iodide technique. The nerve fibers reaching the neighborhood of the epithelium were shown to come from the distal portion of the submucous plexus. In the area of the cells of Langerhans, the fibers are mainly nonmyelinic, grouped together in bundles of different sizes, and surrounded by a common Schwann protoplasm. Towards the distal end, the nerve fibers begin to group together into thin nerve strings until they reach the basal layer, where they initially consist of two or three nerve fibers and later of completely isolated fibers, thus forming a subepithelial plexus in which all the fibers are nonmyelinic and completely varicose, some of them being associated with the blood capillaries in this area. The upper portion of the esophagus (next to the pharynx) and the lower portion (next to the cardia) show the densest penetration by nerve fibers, while the middle portion is penetrated only sporadically by an occasional fiber. In the upper portion, the bottoms of the grooves formed by the longitudinal folds show the greatest penetration of the basal surface by nerve fibers. In the middle portion, the fibers may penetrate at any point in the basal surface; in the lower portion, penetration is generally through the papillae formed by the epithelial covering in this area. The fibers are thin and delicate through their epithelial course and are probably directly attached to the epithelial cell bodies. The nerve fibers within the epithelium end freely in the spaces between the epithelial cells not far from the basal layer or, more frequently, near the lumen of the viscera. The morphology of the terminal ends varied considerably and was not associated with their position within the epithelium. The terminal portions of some of the fibers in the subepithelial plexus in the lower part of the esophagus form delicate laminar expansions which terminate the fiber or are inserted into the preterminal portion. These formations connect only with the cells forming the basal membrane of the epithelium and their endings generally assume a glomerular aspect. No neuroepithelial cells were observed in conjunction with the terminal apparatus. The data suggest that the nerve fibers within the mucous epithelium of the esophagus are solely of a sensory character.

6602 ELECTRONMICROSCOPIC OBSERVATIONS ON THE EFFECTS OF ORALLY ADMINISTERED ASPIRIN AND ASPIRIN-BICARBONATE MIXTURES ON THE DEVELOPMENT OF GASTRIC MUCOSAL DAMAGE IN THE RAT. *(E.)* Rainsford, K. D. (Univ. Tasmania, Medical Sch., GPO Box 252C, Hobart, Australia 7001). *Gut* 16(7):514-527, 1975.

The effects of aspirin (50-200 mg/kg p.o.) and an equimolar mixture of aspirin (200 mg/kg p.o.) with sodium bicarbonate on the fine structure of the gastric mucosa were studied in starved and nonstarved male hooded Wistar rats. The animals were killed 10 min to 5 hr after drug administration. The glandular mucosa was treated with formaldehyde and/or glutaraldehyde fixatives and examined by electron microscopy. In some experiments, the stomachs of rats anesthetized with pentobarbital sodium were perfused with fixative *in situ* prior to sectioning. Aspirin alone produced focal erosions in the corpus and body of the stomach of the fasted animals with evidence of bleeding in and around the eroded areas; the erosions were first evident 1 hr after treatment. Most of the damage occurred in the middle of the greater curvature of the corpus, and the damage was reduced in animals given lower doses of aspirin. Very little if any damage was produced by aspirin alone in the nonfasted animals or by aspirin plus bicarbonate in the fasted animals. Within 10 min after aspirin administration in the fasted rats, the surface mucosal layer assumed a whitish appearance and showed extensive sloughing. Extensive mucosal edema was observed in the starved animals given 150 or 200 mg/kg of aspirin alone, the degree of edema being reduced after 50 mg/kg of aspirin alone, aspirin plus bicarbonate, or 200 mg/kg aspirin in the nonfasted rats. The blood vessels in the stomach were extensively swollen in all rats given aspirin. On a fine structural level, a temporal sequence of events involving direct physical exfoliation of mucosal cells and selective structural damage to the parietal cells followed by structural damage indicative of a disturbance in oxidative and biosynthetic functions in the cells near the developing erosions was observed after 200 mg/kg aspirin in the fasted rats. The data indicate that the presence of aspirin particles in intimate contact with the mucosa is important in the development of gastric damage.

6603 EFFECT OF pH ON BILE SALT INJURY TO MOUSE GASTRIC MUCOSA. A LIGHT- AND ELECTRON-MICROSCOPIC STUDY. *(E.)* Eastwood, G. L. (United States Naval Hosp., Philadelphia, Pa.). *Gastroenterology* 68(6):1456-1465, 1975.

The influence of pH on bile salt-induced gastric injury and the morphological mode of injury were studied. Taurocholate and glycochenodeoxycholate were used. Adult male Swiss mice received solutions by esophageal intubation. Mucosal injury was graded as normal (0), mild injury (1), moderate injury (2), and severe injury (3). Taurocholate at pH 1 caused mucosal injury even at concentrations of only 0.1 mM and at 2 min of exposure (mean grade of severity, 1.9). A light micrograph of this injury showed that almost all surface mucous cells were damaged. There was also a decrease in staining intensity, mottling of the nucleus, and, in some instances, there was cell disruption. The severity of injury was greater with increasing concentration or duration of exposure. Taurocholate had no injurious effect at pH 3, 5 or 7. At pH 1, the mucosal injury caused by glycochenodeoxycholate was less than that caused by taurocholate (2 mM bile salt for 15 min gave a mean grade of severity of 1.1). At pH 3, however, glycochenodeoxycholate produced mucosal injury of grade 1.3; no injury was produced at pH 5 or 7. Electron microscope studies of injuries showed clumping of the nuclear chromatin as being indicative of mild cell injury. Most severely injured cells were often disrupted and sometimes fragmented. It is concluded that the morphological effects of bile salts are not specific and may relate to the ability of the agent, whether it is a primary irritant or a hydrogen ion, to gain entry to the cell interior.

6604 THE EFFECT OF BILE AND OF SODIUM TAUROCHOLATE ON THE EPITHELIAL CELL DYNAMICS OF THE RAT SMALL INTESTINE. *(Eng.)* Roy, C. C.; Laurendeau, G.; Doyon, G.; Chartrand, L.; Rivest, M. R. (Hôpital Sainte-Justine, Montreal, Canada). *Proc. Soc. Exp. Biol. Med.* 149(4):1000-1004, 1975.

The regulatory role of bile and bile acids on epithelial cell dynamics in bile fistula rats after biliary diversion and under a constant duodenal Na taurocholate perfusion was studied. Bile fistula was established by insertion of a cannula in the common duct, 5 mm distal to hepatic duct bifurcation in ten male Sprague-Dawley rats. The control group consisted of ten sham-operated rats. After 48 hr, the absence of bile from the intestinal lumen led to: a decreased proliferative cell pool (based on a decrease of the mucosal scraping DNA specific activity), reduced cell shedding and a 50% decrease of the labeling index in the ileum. Constant duodenal perfusion of Na taurocholate for 48, 60, 72 and 96 hr in animals with biliary diversion was associated with: deepening of crypts, decreased crypt to villus ratios and acceleration of epithelial cell migration rate on the crypt-villus units. The data suggest that bile and, in particular, bile acids constitute important regulatory factors influencing enterocyte proliferation, migration and loss.

6605 EFFECTS OF p-CHLOROMERCURIBENZENE SULFONATE UPON ULTRASTRUCTURE OF CANINE GASTRIC SURFACE CELLS. *(E.)* Zalewsky, C. A.; Moody, F. G.; Simons, M. A. (Univ. Utah Medical Center, 50 North Medical Drive, Salt Lake City, Utah 84132). *Gastroenterology* 69(2):427-438, 1975.

The morphological events involved in acute gastric erosion formation were studied systematically in mongrel dogs of both sexes. Segments of the greater curvature of the stomach were removed from the fasted animals and placed in double lumen lucite chambers. The experimental side of the mucosa was bathed with 10 mM *p*-chloromercuribenzene sulfonate (PCMBS) in 0.14 M HCl or 10 mM PCMBS in 0.1 M Tris buffer adjusted to pH 7.8-7.9 with HCl and made isosmotic with mannitol. The control sides of the mucosa were bathed with 0.15 M HCl, 0.1 M Tris buffer-mannitol without PCMBS. The gastric mucosa was observed visually and the arterial blood pressure was monitored throughout the experiment. The exteriorized segments of stomach were removed at various intervals and examined autoradiographically and by electron microscopy. Exposure of the mucosal surface of the exteriorized fundic segments to PCMBS resulted in gross and microscopic structural changes. The first visible response after PCMBS in isosmotic HCl was an intense release of periodic acid-Schiff-stainable mucous. Within 2 min, radioactive PCMBS was found within cells along the entire depth of the gastric glands. At 15 min, the surface cells showed vacuolization of the cellular cytoplasm, dilation of the perinuclear and intercellular spaces, mitochondrial swelling, loss of microvilli, and plasmalemma irregularities. The tight junctions, Golgi apparatus, and mucous granules appeared unaltered. However, in advanced injury (30 min), the mucous granules became less dense and their membranes, which were normally smooth, became fragmented and convoluted. Necrotic parietal cells were extruded into the lumen. Damage only rarely extended into the deeper glandular and connective tissue areas. Although the changes were of the same morphological type whether the PCMBS was in acid or buffer solution, the changes induced by acidified PCMBS occurred more rapidly and involved a greater number of cells. It is likely that PCMBS alters the permeability characteristics of the plasma membrane facing the lumen and of that part of the membrane forming the lateral sides of the cells.

6606 EFFECT OF DIOCTYL SODIUM SULFOSUCCINATE ON STRUCTURE AND FUNCTION OF RODENT AND HUMAN INTESTINE. *(E.)* Saunders, D. R.; Sillery, J.; Rachmilewitz, D. (Dep. Med. RG-20, Univ. Washington, Seattle, Wash. 98195). *Gastroenterology* 69(2):380-386, 1975.

The hypothesis that dioctyl sodium sulfosuccinate (DSS), an anionic detergent often described as a stool softener, blocks water absorption in the small and large intestines was studied in fasted, anesthetized male Sprague-Dawley rats. Jejunal, ileal, and colonic segments were created and infused with buffer (9.5 ml/min in the small intestinal segments and 0.75 ml/min in the colonic segments) and then with buffer containing DSS (0.1-2.0 mM). Net water transport was measured under steady-state conditions. To test whether the observations in rats were relevant to the human jejunum, segments of jejunum in three healthy men and one healthy woman were studied by the triple lumen tube technique; buffer or buffer containing DSS (0.5-1.0 mM) were infused into the fasted subjects and the jejunal contents were aspirated at various intervals. In the rats, DSS inhib-

ited water absorption in all three segments of intestine, the degree of inhibition being linearly related to the $\log_{10}$ of the DSS concentration. Histologically, the jejunal segments appeared unchanged by DSS infusion, but the detergent (0.5-2.0 mM) did alter the histologic appearance of the surface absorptive cells of the colon. In the latter case, the cells were flattened and their brush borders were no longer readily seen; the number of cells involved increased with increasing DSS concentration. DSS (0.5 mM) also significantly depressed water absorption (by 80%) in the human subjects. The effect was reversible and sodium, potassium, and chloride moved in parallel with the net water transport. The data indicate that DSS could be regarded as a stimulant laxative.

6607 MAST CELL INCREASE IN THE DUODENUM AND KIDNEY OF MAGNESIUM-DEFICIENT RATS. *(E.)* Veilleux, R. (Dept. Anatomy, Univ. Montreal, Quebec, Canada). *Lab. Invest.* 33(1):80-87, 1975.

The possible influence of magnesium deficiency on increasing the population of subepithelial intestinal and kidney mast cells was studied. Of 52 Sprague-Dawley rats, 30 were fed a magnesium-deficient diet, while 10 controls were fed normally. Two controls and six deficient rats were killed after one to five weeks, and pieces of duodenum and kidney were either fixed and stained with Alcian Blue-safranin or quenched in liquid nitrogen cooled monochlorodifluoromethane, freeze-dried, exposed to formalin vapor, and subjected to fluorescence microscopy. Six of the remaining rats were kept on the deficient diet for four weeks, given 100 mg/kg L-dopa i.p. and killed after 2 hr. The last six were normal diet rats given L-dopa. The deficient rats showed a marked increase in duodenal subepithelial mast cells beginning at two weeks. Their mast cells had a more intense yellowish fluorescence than control mast cells. Administration of L-dopa after the fourth week enhanced the fluorescence in both deficient and control rats. After two to three weeks of deficiency, at least a twofold increase of Alcian Blue-positive fluorescent cells could be seen in the lamina propria, which sometimes lined up at the base of the epithelium. In all cases the epithelium itself was devoid of these cells. In the kidney, mast cells were extremely rare or absent in the controls by both Alcian Blue and formalin-induced fluorescence. L-dopa did not disclose any mast cells. In the deficient rats, both staining techniques showed numerous mast cells restricted to the cortex. These were apparent after the second week, mostly in the intertubular spaces. Alcian Blue fluorescent mast cells were also seen in the glomeruli. The intertubular mast cells were sometimes associated with local fibrous proliferative activity, or squeezed into the thin connective tissue sheath surrounding each tubule. The fluorescence ranged from yellow to green, usually contrasting with the intense yellow of the normal mast cells of the hilum and capsule. L-dopa markedly increased the intensity of fluorescence of all mast cells. It is concluded that magnesium deficiency in the rat increases the intestinal subepithelial mast cell population and the kidney cortical tubular and glomerular mast cell population.

6608 MORPHOLOGICAL STUDIES OF THE RAT SMALL INTESTINE AFTER JEJUNO-ILEAL TRANSPOSITION. *(E.)* Gronqvist, B.; Engstrom, B.; Grimelius, L. (Univ. Hosp., Uppsala, Sweden). *Acta Chir. Scand.* 141(3):208-217, 1975.

Changes in small bowel mucosa after jejuno-ileal transposition were studied by light and electron microscopy. Male Sprague-Dawley rats were divided into three groups of nine animals: 1) controls; 2) sham-operated; and 3) jejuno-ileal transposed rats. Specimens of small intestine were taken at 2, 6 and 12 weeks postoperatively, from three rats in each group. Light, fluorescence, scanning electron and electron microscope examinations were made of four biopsy sites: distal to the proximal anastomosis, proximal and distal to the middle anastomosis, and proximal to the distal anastomosis. Weight increase in the third group 2 weeks postoperatively was lower than that of controls (33.4, 20.0 and 0.7% for groups 1, 2 and 3, resp.). At 6 and 12 weeks there was no significant difference between the groups (98.7, 96.0 and 87.5%, resp., at 12 weeks). No cell damage was seen in any group. Fluorescent microscopy showed the same number of cells and the same intensity of staining in all groups. There were no significant differences seen in the lengths and breadths of the villi, nor were changes seen in cytoplasmic organelles or microvilli. Quantitative studies showed that, at 2 and 12 weeks postoperatively, the villi of the ileum in the third group were significantly higher than those of the other two groups (19.7 and 58.4%, resp., at 2 and 12 weeks). The transposed jejunum also showed higher villi at 2 weeks (6.4%), but at 12 weeks the difference had decreased (0.1%). At 2 weeks the cell density in the transposed ileal segments in group 3 animals (229 cells/mm of basement membrane) was significantly higher than in the other two groups (209 and 199 cells/mm, resp., for control and sham-operated animals). At 12 weeks, the values for group 3 animals were significantly lower. From these data the mechanisms governing the development of hypertrophy in the transposed intestine are not clear. It is suggested that alterations in the intraluminal conditions, such as pH, pressure and possibly bacterial flora, may play a role.

6609 MORPHOLOGY IN THE CAT ILEAL MUCOSA FOLLOWING CONSTRUCTION OF AN ILEAL RESERVOIR OR TRANSPOSITION OF PATCHES TO DIFFERENT LOCATIONS. *(E.)* Philipson, B. (Dept. Surgery, Sahlgrenska Inst., S-413 45 Goteborg, Sweden). *Scand. J. Gastroenterol.* 10(4):369-377, 1975.

Whether the structural changes recorded in human ileal reservoirs could be reproduced under similar conditions in cats, and the possibility of reversal of these morphological changes, was studied. Fasted and anesthetized domestic cats were given ileal reservoirs. The cats were also subjected to a variety of transpositions: an ileal patch to the cecum and later to the jejunum; an ileal patch to the urinary bladder; and an ileal segment to the sigmoid colon. At 1 to 3 months after surgery, the animals were sacrificed, and samples were taken from the reservoir, and from the ileum 5 cm proximal and 3 cm dis-

tal to the reservoir. The villi appeared to be shorter than in the normal ileum, and in most instances had leaf- and club-like shapes. Proximal and distal to the reservoir the villi were finger-like. This shape was restored when the patches were removed from the cecum to the jejunum. An inflammatory reaction was noted, which was especially pronounced in patches transposed to the urinary bladder. There was a significant decrease in villous height in the reservoir (353 μ) and distal to it (498 μ) compared to controls (760 μ); in the ileal patches transposed to the cecum (355 μ; control, 760 μ) and jejunum (546 μ; control, 750 μ). The villus height reduction was especially pronounced after transposition to the urinary bladder (266 μ; control, 760 μ). Increases in villus height were accompanied by an increased mitotic index. It is concluded that the structural changes seen in the human reservoir can be reproduced in animal models. These data suggest that the most important factor in the development of mucosal alterations is the irritating nature of the luminal contents.

6610 ELECTRON MICROSCOPIC STUDY OF CHRONIC PANCREATITIS INDUCED BY ADJUVANT INJECTION IN THE DOGS. *(E.)* Tsunoda, T.; Nakayama, I.; Taura, S.; Yoshino, R.; Ito, T.; Tsuchiya, R. (Nagasaki Univ. Sch. Med., Japan). *Nihon Rynsho Denshi Kenoikyo Gakkai-Shi* 7(3/4):345-346, 1974.

**The histogenesis of chronic pancreatitis (induced in dogs) was studied by electron microscopy. Mongrel dogs (10-15 kg) received 1 ml of Freund's complete adjuvant by injection into the pancreatic parenchyma. The animals were sacrificed at 6, 9 and 24 hr, and 2, 4, 6, 8, 10, 20 and 30 days after injection. An increased number of lymphatic vessels with marked dilatation and intensive interstitial edema were noted at 6-24 hr, accompanied by the eduction of fibrin. Granulomatous lesions of various sizes formed in the interstitial tissue at 2-10 days. Each had an evident lumen without necrotic change in the central part, where fat and PAS stains were negative. At 6 days, the endothelial cells disappeared. The lymphatic wall was occupied by various inflammatory cells with granuloma formation. In the last stage of the experiment (20-30 days), some old granulomas still remained in part, but the interstitial tissue was mostly replaced by dense collagen fibers. This last stage closely resembled the histological picture found in human chronic pancreatitis.**

6611 EFFECT OF SUBTOTAL RESECTION OF THE SMALL INTESTINE ON PANCREATIC STRUCTURE AS A FUNCTION OF THE TYPE OF INTESTINAL ANASTOMOSIS. *(Rus.)* Zhuchenko, S. P. (Vinnitsa Medical Inst., USSR). *Klin. Khir.* (5):73-75, 1975.

6612 NERVE NETWORK AND NERVE CELLS OF THE LARGE INTESTINAL WALL. *(Ger.)* Stach, W. (Div. Medicine, Univ. Rostock, Rostock, Germany). *Zentralbl. Chir.* 100(2):75-85, 1975.

6613 STRUCTURAL FEATURES OF THE MUCOSA OF HUMAN FETAL SMALL INTESTINE. *(E.)* Moxey, P. C.; Trier, J. S. (Peter Bent Brigham Hosp., Boston, Mass.). *Gastroenterology* 68(4):1002, 1975.

6614 EFFECTS OF STEROIDS ON MATURATION AND DIFFERENTIATION OF CULTURED FETAL STOMACH. *(E.)* Yeomans, N. D.; Trier, J. S.; Markezin, E. T.; Moxey, P. C. (Peter Bent Brigham Hosp., Boston, Mass.). *Gastroenterology* 68(4):1001, 1975.

6615 HISTOLOGICAL AND HISTOCHEMICAL STUDIES ON ANIMALS ON THE EFFECT OF STIMULUS SUMMATION ON THE GASTRIC MUCOSAL BARRIER. *(Ger.)* Bergmann, M.; Goischke, H. K.; Goischke, E. M. (Medizinische Universitatspoliklinik, DDR-69 Jena, Bachstrasse 18, Germany). *Dtsch. Z. Verdau. Stoffwechselkr.* 34(5/6): 279-286, 1974.

6616 THE LYMPHATIC BED OF THE MUSCLE LAYER OF THE SMALL INTESTINE OF MAN AND ANIMALS IN ONTOGENESIS. *(Rus.)* Gusejnov, T. S. (Dept. Normal Anatomy, Dagestan Medical Inst., Makhach-Kala, USSR). *Arkhiv. Anat. Gistol. Embriol.* 68(5):66-70, 1975.

6617 A CONTRIBUTION TO THE HISTOGENESIS OF THE OESOPHAGEAL EPITHELIUM IN MAN. *(E.)* Sevcenko, G.; Vacek, Z. (Inst. Embryology, Charles Univ., Prague, Czechoslovakia). *Folia Morphol. (Warszawa)* 22(3):217-218, 1975.

6618 A PARAGANGLION CELL IN THE LAMINA PROPRIA OF THE GASTRIC MUCOSA. *(E.)* Fukuda, S.; Seki, A.; Matsuo, Y. (Faculty of Medicine, Univ. Tokyo, Japan). *Nihon Rynsho Denshi Kenbikyo Gakkai-Shi* 7(3-4):335-336, 1975.

6619 CYTOPLAMIC [SIC] CRYSTALLINE STRUCTURE IN HUMAN LIVER CELLS. *(E.)* Takasan, H.; Yamada, T.; Ozawa, K.; Honjo, I. (Kyoto Univ. Sch. Med., Kyoto, Japan). *Nihon Rynsho Denshi Kenbikyo Gakkai-Shi* 7(3-4):251, 1974.

6620 FINE STRUCTURE OF HEPATIC FIBROSIS. *(E.)* Tanikawa, K.; Abe, N.; Miyakoda, U.; Ikejiri, M.; Kawaguchi, M. (Kurume Univ. Sch. Medicine, Japan). *Nihon Rynsho Denshi Kenbikyo Gakkai-Shi* 7(3-4):367, 1975.

See also, 6680, 6730, 6744, 6821, 6822, 6825, 6853, 6907, 6938, 7350, 7397, 7497, 7822.

6621 A MODIFIED FECAL EXCRETION TEST FOR ASSAYING INTESTINAL ABSORPTION OF $^{3}$H-FOLIC ACID. *(E.)* Elsborg, L. (Univ. Dept. Medicine, Aarhus Amtssygehus, DK-8000 Arhus C, Denmark). *Scand. J. Gastroenterol.* 10(2):207-208, 1975.

A folic acid absorption test is described, based on direct estimation of the nonabsorbed fecal fraction of an ingested dose of $^{3}$H-folic acid. Fasting normal subjects (20) were fed 2 μCi (200 μg) of $^{3}$H-folic acid and 0.4 μCi of $^{60}Co_2O_3$. Each of three 24-hr stool collections was placed on a sodium iodide crystal and only the fecal specimen containing the greatest amount of radioactivity was analyzed. Gas proportional counting was used to estimate $^{3}$H activity after homogenization of the sample. The absorption of folic acid was calculated in percent of the amount ingested, given (1.00 - f) x 100%, where f is the unabsorbed fraction of folic acid. The counting efficiency for $^{3}$H was found to be approximately 40%. In the subjects tested, fecal excretion of folic acid fitted well with a logarithmic normal distribution. The 0.95 range for f was 0.05 to 0.25. Accordingly, folic acid absorption ranges from 75% to 95% in normal subjects. It is suggested that this method may be useful for laboratories with less advanced equipment for radiochemical assay.

6622 PERMANENT BILE DUCT CANNULATION IN THE MONKEY. A MODEL FOR STUDYING INTESTINAL ABSORPTION. *(E.)* Meszaros, J.; Nimmerfall, F.; Rosenthaler, J.; Weber, H. (Pharmaceutical Dept., Sandoz Ltd., 4002 Basel, Switzerland). *Eur. J. Pharmacol.* 32:233-242, 1975.

An experimental model for studying the intestinal absorption and biliary excretion of drugs and their metabolites is described. Cannulas of silicon rubber were inserted into the common bile duct up to the entrance of the cystic duct and through the stomach wall and the pylorus into the duodenum (to the entrance of the common bile duct) in 50 male rhesus monkeys. The cannulas were fixed at the point of insertion and the protruding portions were cut and joined to a plexiglass U-tube end-piece; when the animals were not being tested, the two tubes of the end-piece were joined by the U-tube, thereby giving the animals complete freedom. Postoperatively, the animals showed uneventful recovery and remained in normal condition. However, in over 90% of the animals, the catheter system was rejected after 8 or more wk of implantation and shunts were formed for the passage of bile around the point of insertion; this had no apparent detrimental effect on the animals. The specific gravity of the liver bile remained normal postoperatively and BSP tests for liver excretory function yielded values similar to those found in intact monkeys. Among the bile fistula animals, those with low $k^1$-values for BSP elimination showed the highest specific activity levels for alkaline phosphatase, SGOT, SGPT, and glutamate dehydrogenase; the specific activities of these enzymes were similar to those in 23 intact monkeys. Absorption tests carried out in nine bile fistula animals after intraduodenal ergotamine tartrate infusion showed a 96% average recovery of the applied dose and a mean intestinal absorption of 45% of the administered dose; the tests showed satisfactory reproducibility in the same animals over periods of 2 to 36 wk. This model appears to be well suited to studying the intestinal absorption of drugs which are excreted primarily in the bile. By sparing the animals the stress and discomfort of continuous chair sitting during repeated experimentation, it was possible to maintain them in a fit and near-normal condition throughout the study.

6623 PROPERTIES OF GLYCEROL-$^{75}$SE-TRIETHER: A LIPID-SOLUBLE MARKER FOR THE ESTIMATION OF INTESTINAL FAT ABSORPTION. *(E.)* Hoving, J.; Valkema, A. J.; Wilson, J. H. P.; Woldring, M. G. (Univ. Hosp., Groningen, Netherlands). *J. Lab. Clin. Med.* 86(2):286-294, 1975.

The properties of a $^{75}$Se-labeled glycerol triether were investigated in rat (Wistar stain, 180-200 g) experiments designed to test this substance as a nonabsorbable marker for measuring intestinal fat absorption. $^{131}$I-triolein was used as tracer fat, and absorption was calculated using the isotope balance and isotope ratio methods. A mean of 99.4% of the 10 mg $^{75}$Se-triether dose was recovered in the feces during the seven-day collection period. The separation of the lipid extract of the stools on TLC (thin-layer chromatography) revealed several $^{75}$Se-containing compounds, of which one had the same mobility pattern as $^{75}$Se-triether. Nonabsorbability of this compound was almost complete with a 98.2% recovery. All rats survived the experimental period with no significant weight gain, hematological, blood chemistry, or histological changes. No significant difference was noted when the amount of marker was increased. Comparison of methods gave correlation coefficients of 0.99 and 0.89 and regression coefficients of 1.02 and 0.99 depending on the time elapsed from time of administration (0-12 hr and 12-24 hr, resp.), showing that the marker moves through the gastrointestinal tract at the same rate as fat. If marker and test fat are given in a single dose, the estimation of fat absorption from the random stool sample is valid only if the marker/test fat ratio in feces is influenced exclusively by absorption of fat. The simplicity of the $^{75}$Se-triether estimation in feces is a major advantage over other lipid-soluble markers and may provide a reliable and rapid test for estimation of intestinal fat absorption in man.

6624 SODIUM CHLORIDE REFLECTION COEFFICIENT IN RABBIT GALL BLADDER. *(E.)* Monticelli, C.; Celentano, F.; Torelli, G. (Inst. General Physiology Physics, Univ. Milan, via Mangiagalli 32, 20133 Milano, Italy). *Biochim. Biophys. Acta* 401(1): 41-50, 1975.

The relation between volumetric flow and its driving forces, containing the Staverman reflection coefficient, was tested for sodium chloride in rabbit gallbladder and the reflection coefficient was evaluated. Everted gallbladders were perfused; the volumetric flow was measured gravimetrically. Experiments were performed with 15 gallbladders, varying sucrose con-

centration in a mucosal bathing solution between 0 and 200 mM, while the serosal solution (118.4 mM of NaCl, 25 mM of $NaHCO_3$, 4.7 mM of KCl, 2.5 mM of $CaCl_2$, 1.2 mM of $KH_2PO_4$ and 1.2 mM of $MgSO_4$, type A) remained unchanged. There was a linear dependence of the volumetric flow ($J_v$) on sucrose osmotic pressure difference in the concentration range of 0 to 80 mM. The permeability coefficient ($L_p$) in this range was $0.507 \times 10^{-11}$ cm$^3$ x dine$^{-1}$ x s$^{-1}$. Gallbladder permeability at higher sucrose concentrations decreased to reacn a steady value at $0.124 \times 10^{-11}$ cm$^3$ x dine$^{-1}$ x s$^{-1}$ above 100 mM of sucrose. Negative $\Delta\pi_g$ (the partial osmotic pressure difference of solute S in the two compartments) values were obtained by lowering NaCl concentration in the outside solution, while these values were positive when the salt concentration was increased in the same solution. Volumetric flow was linearly related to $\Delta\pi_g$ and $\Delta\pi_i$. The mean reflection coefficient was 0.60, and the apparent reflection coefficient was found to depend on experimental conditions. It is concluded that a measure of membrane specificity for a species which is both actively and passively transported can be obtained only by accounting explicitly for the active transport contribution to volumetric flow.

6625 STUDIES OF GASTROINTESTINAL INTERACTIONS. VII. CHARACTERISTICS OF THE ABSORPTION PATTERN OF SUGAR, FAT AND PROTEIN FROM COMPOSITE MEALS IN MAN. A QUANTITATIVE STUDY. *(E.)* Johansson, C. (Dept. Medicine and Gastroenterology, Karolinska Inst., Stockholm, Sweden). *Scand. J. Gastroenterol.* 10(1): 33-42, 1975.

The characteristics of carbohydrate, fat and protein absorption from composite meals during transit through the upper intestine were studied. Intubated healthy volunteers received 300 ml of two liquid test meals on different occasions. The first meal contained 3.6 g of protein/100 ml, 5.9 g of corn oil/100 ml, 5.1 g of lactose/100 ml and 10 g of glucose/100 ml. The standard test meal was the same, excluding the glucose. Polyethylene glycol (3 g/100 ml) was used as a marker. An average of 75% of the emptied amounts of sugar and 80% of the emptied fat and protein was absorbed during transit through the proximal 70 cm of the intestine. Differences in the absorption patterns between the two meals were recorded, resulting from their different intragastric behavior and gastric emptying patterns. Within the first hr significantly higher amounts of fat and protein were absorbed after the glucose-free than after the glucose-containing meal, whereas from the latter most of the glucose was absorbed early after ingestion. The absorptive capacity of the investigated segment was not exceeded for any component of the meals, owing to compensatory mechanisms by which the gastric emptying rate was inhibited and the transit time through the segment prolonged. The efficiency of sugar absorption was related to the transit time through the segment, in that a constant fraction was eliminated from the intestinal lumen/min increase of the mean transit time. The net endogenous contribution of protein and fat at the exit of the segment amounted to an average of 3.0 g protein and 1.2 g fat during 3 hr. These data suggest that the absorption rate is determined by the gastric emptying rate, which is in turn regulated by limiting factors released after absorption of the nutrient into the mucosal cell.

6626 INTERACTION OF AMINO ACIDS, PEPTIDES AND PEPTIDASES IN THE SMALL INTESTINE. *(E.)* Cheeseman, C. I.; Smyth, D. H. (Dep. Physiol., Univ. Sheffield, England). *Proc. R. Soc. Lond. (Biol.)* 190(1099):149-163, 1975.

The effects of various amino acids, peptides and peptidases on intestinal absorption were studied in Sheffield rats. Everted sacs prepared from the combined jejunum and ileum were shaken for 30 min in bicarbonate saline solution containing β-alanine, L-alanine, L-proline, L-methionine, D-methionine, L-leucine, L-histidine, glycyl-L-leucine, L-leucylglycine, glycylglycine, D-leucyl-glycine, L-leucyl-L-alanine, and/or cobalt chloride; in some experiments, part of the Na in the bicarbonate saline was replaced by choline chloride. In another set of experiments, the combined jejunal-ileal segments were homogenized and the resulting suspension was shaken with bicarbonate solution containing the above-mentioned substances. The hydrolysis of glycylglycine by the intestinal homogenates was significantly inhibited by all amino acids tested except L-proline and L-alanine, L-histidine being by far the most effective inhibitor. Glycyl-L-leucine hydrolysis was also significantly inhibited by L-leucine, L-methionine, and L-histidine, while all amino acids tested except L-histidine significantly stimulated L-leucylglycine hydrolysis; in the latter case, L-histidine was a strong inhibitor. Similar results were obtained with the everted sacs. There was no evidence of competition between amino acids and dipeptides for an entry mechanism, but there was evidence for competition between different dipeptides. Cobalt caused stimulation of the dipeptidases in the homogenates but not in the everted sacs, which suggested that the dipeptidase was not accessible to cobalt in the intestinal lumen. The entry process of D-leucyl-glycine into the intestine showed evidence of saturation kinetics and was inhibited by reduction of the Na concentration in the bicarbonate solution. The results indicate that the terminal stage of digestion involves intracellular hydrolysis rather than contact hydrolysis, and point to a specific mechanism for peptide entry into the enterocyte from the lumen of the intestine.

6627 UPTAKE OF TAUROCHOLIC ACID INTO ISOLATED RAT-LIVER CELLS. *(E.)* Schwarz, L. R.; Burr, R.; Schwenk, M.; Pfaff, E.; Greim, H. (Institut fur Toxikologie der Eberhard-Karls-Universitat Tubingen, D-7400 Tubingen, Wilhelmstrasse 56, Federal Republic of Germany). *Eur. J. Biochem.* 55(3):617-623, 1975.

The uptake of taurocholic acid into isolated rat liver cells was studied to further characterize the processes involved. Liver cells isolated from male Sprague-Dawley rats were incubated in a suspension containing 60 nCi of [$^{14}$C]taurocholate/ml of incubation medium and various concentrations of unlabeled

taurocholate. Adsorption of taurocholate to the cell surface was terminated in less than 15 sec. A saturation constant of 0.55 mM and a total binding capacity of 3.8 nM/mg of cell protein were determined. The rate of uptake of taurocholate followed Michaelis-Menten kinetics, with the $K_m$ equal to 19 μM and V equal to 1.7 nM/mg of protein/min. There was a broad pH optimum observed for uptake between pH 6.5 and 8.0. The activation energy amounted to 29 kcal/M. At high taurocholate concentrations (10 and 50 μM), an unusual upward bend was observed in the Arrhenius plot at lower temperatures. Taurocholate uptake was completely inhibited by taurochenodeoxycholate ($K_i$ = 9 μM) and was noncompetitively inhibited by BSP ($K_i$ = 3 μM). At physiological taurocholate concentrations, a 200-fold intracellular accumulation of taurocholate was observed. Uptake was inhibited by about 75% by either antimycin A, carbonylcyanide *m*-chlorophenylhydrazone or ouabain. Replacement of extracellular $Na^+$ by either $K^+$ or sucrose resulted in a 75% decrease of uptake. It is concluded that taurocholate uptake is a carrier-mediated process. It is further suggested that the energy for intracellular accumulation is made available by cotransport of $Na^+$.

6628 EFFECT OF DIET AND MICROBIAL FLORA ON INTESTINAL ABSORPTION OF SODIUM TAUROCHOLATE IN GERM-FREE RATS. *(E.)* Riottot, M.; Sacquet, E.; Mejean, C.; Leprince, C. (Laboratoire des Animaux sans Germes, C.N.R.Z., Jouy-en-Josas 78350, France). *Nutr. Rep. Int.* 12(1):1-7, 1975.

The effects of diet and microbial flora on the rate of intestinal absorption of sodium taurocholate were studied in germfree (axenic) and conventional (holoxenic) rats. The rats were maintained on a semi-synthetic diet containing no cholesterol or on a commercial diet containing 90 mg of cholesterol/100g of food. Segments of the small intestine were perfused with solutions of sodium taurocholate (2,4-$^3$H) or (4-$^{14}$C) and absorption was determined using liquid scintillation spectrometry. The perfusion method of Kimura was used to study absorption across the jejunum and ileum, while the perfusion method of Schiff was used to study absorption across the ileum only. The rate of absorption across the jejunum increased with increases in the amount of taurocholate in the perfusate; the augmentation was proportional to the taurocholate concentration in the rats given the commercial diet, but tended to be greater at the highest concentration (25 mM) in the rats given the semi-synthetic diet. Using Kimura's technique, the absorption rate was found to be higher in the ileum, where it increased considerably with increasing sodium taurocholate concentration. The absorption rate was not significantly affected by the presence or absence of intestinal microflora, but was much higher in the animals fed the commercial diet than in those fed the semi-synthetic diet. The results obtained using Schiff's technique were similar, but the absorption rates were lower and increased more slowly with increasing taurocholate concentration than was observed with Kimura's technique. The results suggest that the digestive tract microbial flora change the intestinal bile salt pool by mechanisms other than a variation in the bile salt absorption rate. It is also hypothesized that food cholesterol is responsible for the increase in the bile salt pool and absorption rate in the rats fed the commercial diet.

6629 EFFECT OF PARENTERAL ACETAZOLAMIDE ON INTESTINAL ABSORPTION OF SALT AND WATER IN MAN. *(E.)* Gerson, C. D.; Cohen, N.; Finkel, M.; Janowitz, H. D. (Mount Sinai Sch. Medicine, City Univ. New York, N.Y.). *Proc. Soc. Exp. Biol. Med.* 149(4):950-952, 1975.

The effect of i.v. acetazolamide administration on jejunal absorption was studied in man. After an overnight fast, six volunteers had a triple lumen tube inserted just beyond the ligament of Treitz. The proximal jejunum was infused with isotonic saline (154 mEq/ml at 9.5 ml/min). Polyethylene glycol (1.0%) was used as a dilution indicator. At the time infusion began, i.v. infusion was also started using 5% aqueous glucose. After 1 hr for equilibration and a second 1 hr period for a control study, acetazolamide was added to the i.v. perfusate (75 mg/kg) and infused for a 2-hr period. Measurements were taken during the second hr. During the two study periods, proximal and distal aspirates were collected at 1 ml/min. Proximal and distal collecting ports were separated by 30 cm. Aspirate determinations were made for water, sodium, chloride and bicarbonate flux. Each subject absorbed less water during the experimental than the control study period. The difference in mean values for the two periods (1.40 and 0.18 ml/cm/hr, resp.) was significant. Sodium absorption was reduced in five subjects, and chloride absorption dropped in all from means of 0.331 to 0.049 during perfusion of the drug. Mean bicarbonate concentration rose from 5.3 to 5.6 mEq/l, an insignificant change. It is concluded that i.v. acetazolamide has an inhibitory effect on jejunal absorption of sodium, chloride and water.

6630 PROPERTIES OF ($Na^+$ + $K^+$)-ACTIVATED ATPase IN RAT LIVER PLASMA MEMBRANES ENRICHED WITH BILE CANALICULI. *(E.)* Boyer, J. L.; Reno, D. (Dept. Medicine, Univ. Chicago, 950 E. 59th St., Chicago, Ill. 60637). *Biochim. Biophys. Acta* 401(1):59-72, 1975.

The properties of ATPase were evaluated with reference to the possible role of ($Na^+$ + $K^+$)-activated ATPase as a determinant of bile salt-dependent canalicular secretion in the rat. Membranes enriched with bile canaliculi were isolated from the hepatocytes of male albino Sprague-Dawley rats and optimum conditions for assaying ($Na^+$ + $K^+$)-activated ATPase were established. Enzyme marker studies of plasma membrane fractions revealed minimal contamination with non-plasma membrane material. The protein yield averaged 0.32 mg of protein/g of liver. Membrane ($Na^+$ + $K^+$)-activated ATPase activity was reproducible, and remained stable at 5 C. There was a linear relation between protein concentration and enzyme product over a 50 to 200 g protein range. When the sodium and potassium ion concentrations

were varied, activity increased with $Na^+$ concentrations up to 150 mM, but diminished at 200 mM. Increases in $K^+$ concentrations above 5 mM had no effect. Imidazole was found to be the preferable buffer for assay of $(Na^+ + K^+)$-activated ATPase activity and the optimum pH was 7.8, while $Mg^{2+}$-activated ATPase activity was most active at pH 8.0. Optimal specific activities of $(Na^+ + K^+)$- and $Mg^{2+}$-activated ATPase activity occurred with $Mg^{2+}$ concentrations between 1.0 and 2.5 mM. Higher $Mg^{2+}$ concentrations resulted in diminished enzyme activity. Both the $Na^+ + K^+$ and the $Mg^{2+}$-activated enzyme activities were temperature-dependent. Increasing concentrations of ouabain or scillaren progressively inhibited $(Na^+ + K^+)$-activated ATPase activity, but neither had any effect on $Mg^{2+}$-activated enzyme activity. These data suggest that the $(Na^+ + K^+)$-activated ATPase activity in this membrane preparation are localized to the bile canaliculi, and are important to the secretion of bile salt-independent flow. Further investigations are recommended.

6631 EFFECT OF ASPIRIN ON IONIC MOVEMENT AND ACID HYDROLASE ACTIVITY OF EXPLANTS OF CANINE ANTRAL AND DUIDENAL MUCOSAE. *(E.)* Himal, H. S.; Greenberg, L.; Boutros, M. I. R.; Waldron-Edward, D. (Div. Surgical Res., McGill Univ., Montreal, Quebec, Canada). *Gastroenterology* 69(2):439-447, 1975.

The activities of six acid hydrolases in antral and duodenal mucosae were determined before and after treatment with aspirin, and activity changes were correlated with mucosal barrier breakdown and changes in ion flux. Mongrel dogs were fasted 24 hr. The stomach was transected between the oxyntic gland area and the pyloric canal, and the antrum with intact blood supply was placed in a Lucite chamber. In five more dogs, the common bile duct was ligated and divided, and the mid-duodenum was devascularized, preserving the pancreaticoduodenal vascular arcade. The duodenum was transected between the major pancreatic portal duct and the pyloric sphincter, and the proximal duodenum was mounted in a Lucite chamber. Basal secretion was collected for 30 min, and test solutions of aspirin, hydrochloric acid and sodium chloride were instilled for 30 min and then aspirated. $Na^+$, $K^+$, $H^+$, and $Cl^-$ concentrations were determined. Mucosae from inside and outside the chamber and mucosae from control dogs were washed, homogenized, and assayed for cathepsin D, acid phosphatase, α or β-galactosidase, β-*N*-acetyl-glucosaminidase, and aryl sulfatase. Protein and soluble RNA were also determined. The hydrochloric acid-salt solution caused a net loss of $H^+$ and $Cl^-$ and a net gain of $Na^+$ and $K^+$. Aspirin treatment caused a much greater $H^+$ loss and $Na^+$ gain. Treatment also caused a rise in fluid volume secreted (from 0.00 to 0.20 ml/30 min by 120 min). Duodenal secretion rose from a basal value of 0.55 ml/30 min to 2.0 ml/30 min after acid-saline treatment. Aspirin treatment caused this value to fall to 1.82 ml/30 min after 120 min. Acid-saline caused great loss of $H^+$. Net $H^+$ loss was 1.8 μEq/cm$^2$ in the duodenum, as compared to 16,8 μEq/cm$^2$ in the antrum. $Na^+$ gain was 14 times and $K^+$ gain four times greater in the duodenum than in the antrum. Nonsedimenting proteins per gram of dry tissue was nearly equal in the antrum, fundus and duodenum; the fundus contained the most RNA. Cathepsin D activity was consistently higher in the stomach than in the duodenum. Treatment with aspirin and subsequent acid-saline washings increased the activities of five of the six acid hydrolases. It is concluded that aspirin acutely increases the activity of the acid hydrolases of the antrum and decreases that of the duodenum.

6632 INTESTINAL ABSORPTION OF FREE AND PROTEIN-BOUND DIETARY METHIONINE IN THE RAT. *(E.)* Canolty, N. L.; Nasset, E. S. (Dept. Nutritional Science, Univ. California, Berkeley, Calif.). *J. Nutr.* 105(7):867-877, 1975.

Studies were undertaken to determine whether the rate of absorption of free dietary methionine differs from that of methionine incorporation in dietary protein. Isotopically-labeled compounds of methionine, L-[$^{35}$S]-methionine ($^{35}$S-Met), L-[$^{75}$Se]methionine ($^{75}$Se-Met), and 1 mCi/mg of selenomethionine were used as tracers in the test meals. Liquid or cooked and dried egg white was used in meals fed to male Long-Evans rats. Plasma and gastrointestinal contents were collected from 15 min to 16 hr after feeding. Plasma amino acids were determined after *ad libitum* diets containing free methionine. Protein-bound methionine in fresh egg white and free methionine left the stomach at the same rate, but protein-bound methionine in dried egg white was emptied from the stomach significantly more slowly than free methionine. Free methionine was absorbed from the intestine more rapidly than the protein-bound form. Concentrations and molar ratios of various amino acids in plasma changed briefly in response to methionine-supplemented test meals (0.4 g). Long-term changes were observed when methionine-supplemented diets were fed *ad libitum*. It is suggested that free dietary amino acids may induce adverse changes in plasma amino acid patterns.

6633 EFFECTS OF DIETARY LACTOSE AND A LACTASE PREPARATION ON THE INTESTINAL ABSORPTION OF CALCIUM AND MAGNESIUM IN NORMAL INFANTS. *(E.)* Kobayashi, A.; Kawai, S.; Ohbe, Y.; Nagashima, Y. (Natl. Children's Hosp., Taishido 3-35-31, Setagaya Ku, Tokyo, Japan). *Am. J. Clin. Nutr.* 28(7):681-683, 1975.

The effects of dietary lactose and the administration of a lactase preparation on intestinal absorption of calcium and magnesium were studied. Fecal excretion of calcium and magnesium was measured in 15 healthy infants (age range, 2-8 months), divided into three groups receiving: a proprietary milk (eight infants); a lactose-free milk (four); and a proprietary milk plus a lactase preparation (three). The mean percent absorption of calcium in the first group was 60.4%, and of magnesium, 57.7%. Infants in the second group showed a significantly reduced mean absorption of both calcium and magnesium (36.5% and 39.3%, resp.) compared to the first group. The mean absorption of calcium and magnesium in the third group

(71.9% and 80.9%, resp.) was enhanced compared to the other two groups. A stimulating effect of dietary lactose on the intestinal absorption of both calcium and magnesium is suggested.

6634 ANALOG MODEL OF KINETICS OF CALCIUM IN HEALTHY SUBJECTS DURING ALIMENTARY Ca ABSORPTION. *(E.)* Brodan, V.; Hajek, M.; Kocian, J. (Inst. Clinical Experimental Medicine, Prague, Kre 14622, Budejovicka 800, Czechoslovakia). *Comput. Biol. Med.* 4(3-4):257-267, 1975.

Short-term changes which take place under the acute transient impairment of calcium during alimentary Ca absorption were studied in healthy 20- to 22-yr-old men. Over the course of several months, all subjects were given $^{47}Ca$ as $CaCl_2$ by the i.v. (10 µCi in 1 ml saline) and p.o. (30 µCi in 100 ml of distilled water) routes; in addition, 30 µCi of $^{47}Ca$ was administered p.o. as $CaCl_2$ along with 10 mg/kg of nonlabeled Ca as $CaCl_2$ in 100 ml of distilled water. The subjects were fasted prior to Ca administration and blood was drawn 0-300 min after administration to determine the blood calcium level and plasma Ca activity. Based on the results, an analog model of the kinetics of calcium in the organism was constructed. The model was composed of a system of ordinary simultaneous differential equations which were resolved on an analog computer. The four-compartment model is characterized by six rate constants, by the ratio of plasma volume to the extravascular compartment of extracellular fluid, and by three regulatory relations. The first three rate equations describe the short-term kinetics of inactive Ca during alimentary absorption; the others describe the kinetics of $^{47}Ca$ under the same conditions. The regulatory relations between the digestive tract and plasma reduce the percentage of Ca absorption when its supply is increased. The proportional and integrating regulatory relations between the Ca pool in the extracellular fluid and the rapidly exchangeable Ca pool (particularly in the skeleton) affect the exchange of Ca between these two compartments. The back flow of Ca from the plasma into the bowel is important in the normalization of disturbed plasma calcium level after Ca injection or ingestion. This model is conceived as one of the steps leading toward an accurate mathematical analysis of the complex processes involved in the maintenance of calcium homeostasis in the organism.

6635 CALCIUM AND STRONTIUM TRANSFER THROUGH THE INTESTINAL WALL IN 6- AND 26-WEEK OLD RATS. *(E.)* Stacic, M.; Gruden, N. (Institut za medicinska istrazivanja i medicinu rada Jugoslavenske akademije znanosti i umjetnosti, Zagreb). *Arh. Hig. Rada Toksikol.* 25(4):423-426, 1974.

The effects of age on the transport of calcium and strontium through different segments of the intestine were studied in 6- and 26-week-old female albino rats. Everted sacs were constructed from the duodenum, jejunum, and ileum of the fasted animals and were incubated with modified Krebs-Ringer solution containing 10 µCi of carrier-free $^{45}Ca$ or $^{85}Sr$ (only in the outside solution) and either calcium or strontium chloride ($0.5 \times 10^{-4}$ M). The activity of each marker was determined in the serosal and mucosal solutions and in the intestinal segments. Calcium and strontium transport in the duodenum was diminished in the older rats, the effect of age being most pronounced in the case of Ca. Strontium transport through the distal portions of the intestine was significantly greater than through the duodenum in the older animals. Although calcium was absorbed to a lesser extent than strontium in all animals, the difference was more pronounced in the younger rats. The retention of calcium and strontium was significantly greater in the duodenal wall of the younger rats; however, the biggest difference between calcium and strontium retention in the younger animals occurred in the duodenal segment. The data confirm previous observations that the absorption and transport of calcium in the duodenum diminish with age.

6636 CALCIUM ABSORPTION BY INTESTINE: STIMULATION IN VITAMIN D-DEFICIENT NEPHRECTOMIZED RATS BY Solanum glaucophyllum. *(E.)* Walling, M. W.; Kimberg, D. V. (Harvard Medical Sch. Boston, Mass, 02215). *Gastroenterology* 69(1):200-205, 1975.

Vitamin-D deficient male Holtzman rats were used to study the effects of nephrectomy and a diet containing *Solanum glaucophyllum* on calcium absorption. A low-calcium diet was fed for seven weeks, and two days prior to death all rats were fed a low salt diet to minimize effects on renal insufficiency. Twenty-four hr prior to death the rats were subjected to either a sham operation or total bilateral nephrectomy. Immediately after surgery either 1.0 ml of isotonic saline or acqueous *Solanum* extract was given i.p. Duodenal calcium transport was studied *in vitro* using $^{45}C$ as tracer in modified Ussing-flux chamber apparatus. Plasma calcium, magnesium, phosphorus, creatinine, and alkaline phosphatase were measured. Prior administration of *Solanum* extract (250 mg dry leaf) increased active absorption 6.2-fold in sham operated, vitamin-D deficient rats and 4.5-fold in nephrectomized animals. Serosal to mucosal flux of calcium and tissue conductance was unchanged by any experimental condition. *Solanum* extract elevated plasma calcium, magnesium, and phosphorus levels but depressed alkaline phosphatase levels compared with controls. Nephrectomy increased plasma magnesium and creatinine but depressed calcium and alkaline phosphatase levels in both control and *Solanum*-treated animals. The data demonstrates that *S. glaucophyllum* leaf contains a water-soluble substance which stimulates active calcium absorption by the duodenum and can effect absorption without the influence of renal tissue. The biological action of *S. glaucophyllum* apparently bypasses the normal means of regulating calcium absorption.

6637 COMPARATIVE STUDIES OF THE INTESTINAL ABSORPTION OF ($^{3}H$)PTEROYLMONOGLUTAMATE AND ($^{3}H$)PTEROYLHEPTAGLUTAMATE IN MAN. *(E.)* Godwin, H. A.; Rosenberg, I. H. (Baylor Coll. Medicine, Houston, Tex.). *Gastroenterology* 69(2):364-373, 1975.

The absorption of synthetic $^{3}$H-pteroylheptaglutamate (folate) was studied quantitatively in 11 normal volunteers and compared with absorption of synthetic $^{3}$H-pteroylglutamic acid (folic acid) absorption. After an overnight fast, a venous blood specimen was taken, and the bladder was voided. Each subject was given p.o. 0.6 μM of either one of the labeled folates. Venous blood samples were taken at 30 min and at 1, 2, 3, 4, and 5 hr. Total urine collections were taken at 0 to 4, 8 to 12, 12 to 24 and 24 to 48 hr. After the first 4 hr of testing, fasting was ended and 15 mg of unlabeled folic acid was given i.m. to flush absorbed folate from the tissues and to maximize urinary recovery. In three subjects, tests were repeated after 3 to 4 days. Urine was analyzed by chromatography and electrophoresis; radioactivity of urine and plasma was determined by scintillation counting. Following the dose of folic acid, total urinary excretion of radioactivity over 48 hr was 70.8%. After the dose of folate, urinary radioactivity excretion was 56.1%. Results were reproducible in two patients given repeated tests. Time patterns of urinary excretion of radioactivity were identical for both folic acid and folate. About 5% appeared during the first four hr. After flushing, 50% of the urinary radioactivity appeared during the following four hr. About 20% appeared after 8 to 12 hr, 15% after 12 to 24 hr, and 90% total for 25 hr. After 24 hr, excretion ranged from 1.4 to 19.6%. A second flush raised the excretion of folate, but not of folic acid. Mean stool excretion over three- or four-day collection periods were 37.7% for folate and 24.4% for folic acid. Elevated plasma radioactivity was detectable 30 min after the dose of either folic acid or folate. Peak activity occurred at 1 hr and 2 hr, resp. Flushing caused a marked rise from displaced extravascular folate, whichever drug was used. The label in the serum was attached to monoglutamyl folate. Presence of free folate was demonstrated by assay with *Lactobacillus casei*. Intact folic acid polyglutamates were not demonstrable in the serum. Analysis of urine showed that 67 to 85% of the radioactivity in 4 to 8 hr migrated with standard pteroylmonoglutamates. It is concluded that synthetic folate is absorbed efficiently, but not as well as synthetic folic acid.

6638 MECHANISM AND SITE OF SMALL INTESTINAL ABSORPTION OF α-TOCOPHEROL IN THE RAT. *(E.)* Hollander, D.; Rim, E.; Muralidhara, K. S. (Dept. Medicine, Wayne State Univ., Detroit, Mich. 48201). *Gastroenterology* 68(6):1492-1499, 1975.

The mechanism of intestinal absorption of α-tocopherol and the regional differences of its absorption by the small intestine were studied using male Sprague-Dawley rats. Everted small bowel sacs were incubated in a micellar medium. The mean absorption rates of the vitamin at 300 μM incubation solution concentration by proximal, medial, and distal small bowel segments were 2.2, 3.4, and 2.0 nM/min/100 mg, resp. The rate of absorption was not changed by the addition of 2,4-dinitrophenol, sodium azide, or potassium cyanide to the incubation medium. A linear increase in the absorption rate was achieved by stepwise increase in incubation solution tocopherol concentration up to 1200 μM. In all experiments, the rate of absorption of the vitamin by the medial portion of the small intestine was significantly higher than the rate of absorption of the vitamin by the proximal and distal small bowel segments. Transmural transport of the vitamin into the serosal compartment did not occur. Accumulation of the vitamin in the submucosal lymphatic spaces was confirmed by autoradiographic examination of the tissue after incubation. It is concluded from these studies that the absorption of α-tocopherol by the rat small intestine is a passive diffusion process taking place at the highest rate in the medial portion of the small intestine.

6639 TRANSPORT OF AMYLASE ACROSS THE APICAL MEMBRANE OF THE PANCREATIC EXOCRINE CELLS. QUANTITATIVE ANALYSIS OF ZYMOGEN GRANULES. *(E.)* Dandrifosse, G.; Simar, L. (Lab. General Comparative Biochemistry, Univ. Liege, Place Delcour, 17 B-4000 Liege, Belgium). *Pfluegers Arch.* 357(3/4):361-368, 1975.

A study is presented disproving the possibility that some types of zymogen granules, ready for secretion, are destroyed by homogenization or centrifugation processes, leading to the presence of amylase in the agranular fraction of the cell. Slices were prepared from the pancreas of pigeons which had been fed *ad libitum* or fasted for 24 hr. One slice was fixed for electron microscopy; the others were homogenized and centrifuged. The number of zymogen granules ($N_v$) and their surface density ($S_v$) were higher in slices derived from starved pigeons ($315/mm^3$ and $15 \times 10^{-4}$ $cm^2/cm^3$, resp.) than the number in slices from fed animals ($60/mm^3$ and $1.8 \times 10^{-4}$, resp.). There was no significant difference noted in the isolated subcellular fractions compared to whole slices: 334 and $63/mm^3$ for the $N_v$; and $12.7 \times 10^{-4}$ and $1.6 \times 10^{-4}$ $cm^2/cm^3$ for the $S_v$ of fasted and fed pigeons, resp. These data support previous suggestions that amylase can be transported molecule by molecule across the intact apical membrane of pancreatic exocrine cells.

6640 TRANSPORT OF DEUTERIUM OXIDE ACROSS ISOLATED RAT SMALL INTESTINE. *(E.)* Bywater, R. J.; Fisher, R. B.; Gardner, M. L. G. (Univ. Edinburgh Medical Sch., Teviot Place, Edinburgh, EH8 9AG, Scotland). *J. Physiol. (Lond.)* 249(3):591-600, 1975.

The transport of deuterium oxide from a luminal perfusate containing 1% $D_2O$ was studied in isolated perfused intestinal segments from anesthetized female rats. The lumen was perfused with bicarbonate saline medium containing glucose (5 mg/ml, 28 mM). After allowing the luminal conditions to stabilize, serial collections of the serosal secretion were made over 2-min periods. The deuterium oxide concentrations in the secretion samples and luminal perfusate were determined, and the results were analyzed using a digital computer program. The kinetics of the appearance of $D_2O$ in the intestinal secretion fitted well into a single exponential function, the steady-state concentration of $D_2O$ in this secretion not differing significantly from the concentration in the luminal

perfusate. The total tissue water contained $D_2O$ at a concentration which averaged 5% lower than that in the luminal perfusate. There was no evidence to suggest discrimination in transport across the intestinal mucosa between $H_2O$ and $D_2O$. The kinetics of wash-in of $D_2O$ to the intestinal secretion indicated that the ratio of flux out of the lumen to reflux back into the lumen was 1.38:1.

6641 EFFECT OF ETHANOL ON SODIUM-DEPENDENT GLUCOSE TRANSPORT IN THE SMALL INTESTINE OF THE HAMSTER. *(E.)* Dinda, P. K.; Beck, I. T.; Beck, M.; McElligott, T. F. (Hotel Dieu Hosp., Kingston, Ontario, Canada K7L 3H6). *Gastroenterology* 68(6): 1517-1526, 1975.

The effects of ethanol on the transmucosal potential difference, water and glucose transport, and intracellular electrolyte concentration of the small intestine were studied in isolated segments from female hamsters. Three series of experiments were performed. Intestinal preparations were all incubated in Krebs-Ringer bicarbonate solution containing 10 mM of glucose (control). Series 2 also contained 300 mM of ethanol (1.28 g/100 ml), and series 3, 450 mM of ethanol (2.07 g/100 ml). The presence of ethanol caused an inhibition of the net transport of water and glucose, a decrease in intracellular water content, and an increase in intracellular sodium and potassium concentrations. The intracellular glucose concentration, however, decreased in the presence of ethanol. In the series 3 experiments there was also a significant inhibition of transmucosal potential difference, estimated glucose metabolism and both unidirectional (mucosal to serosal and serosal to mucosal) fluxes of sodium. The net flux of sodium to the serosal side did not decrease significantly. It is suggested that the ethanol-induced reduction in glucose transport could be the result of an interference with the carrier-mediated coupled entrance of glucose and sodium across the brush border.

6642 CATECHOLAMINE EFFECTS ON CYCLIC AMP LEVELS AND ION SECRETION IN RABBIT ILEAL MUCOSA. *(E.)* Field, M.; Sheerin, H. E.; Henderson, A.; Smith, P. L. (Harvard Medical School, Boston, Mass. 02215). *Am. J. Phys.* 229(1):86-92, 1975.

The effects of catecholamines on cyclic-AMP (cAMP) and on cAMP-mediated ion transport processes in rabbit ileal mucosa were studied. New Zealand white male rabbits weighing 2-3 kg were used as tissue source. The base-line cAMP level was not affected by epinephrine, norepinephrine, or isoproterenol. Propranolol did not enhance the lowering trend produced by epinephrine on theophylline-augmented cAMP levels indicating that adenylate cyclase-coupled β-adrenergic receptors are not present in significant numbers in ileal mucosa. An increase in cAMP level produced by cholera toxin was reversed by epinephrine and norepinephrine; this reversal was prevented by phenoxybenzamine. Epinephrine partially reversed the increase in cAMP levels produced by prostaglandin $E_1$ indicating that the inhibitory effect is nonspecfic. In the presence of epinephrine alone there was substantial and equal net absorptive fluxes of Na and Cl ions, a low short-circuit current (SCC), high conductance, and a residual ion flux close to zero indicating enhancement of NaCl absorption and inhibition of $HCO_3$ secretion. In the presence of theophylline, cAMP or cholera toxin, epinephrine produced a decrease in SCC and an increase in conductance. The effects of α-adrenergic stimulion intestinal ion transport may not be primarily the result of changes in cAMP levels. Changes in ion transport cannot be safely inferred from changes in cAMP levels of whole mucosa and *vice versa*.

6643 EFFECT OF HORMONES ON PANCREATIC MACROMOLECULAR TRANSPORT. *(E.)* Singh, M.; Webster, III, P. D. (Veteran's Administration Hosp., Augusta, Ga.). *Gastroenterology* 68(6):1536-1542, 1975.

The effects of acute and chronic administration of cholecystokinin-pancreozymin (CCK-PZ), pentagastrin and secretin on pancreatic macromolecular synthesis and secretion were studied *in vitro*. Pancreatic slices were prepared from male Sprague-Dawley rats. Pooled slices were pulse-labeled with L-[$^{14}$C]phenylalanine (10 μCi, 22 μM) and migration of $^{14}$C-labeled proteins was studied by "chase" incubation for 15, 30, 60 and 120 min. After incubation of control and drug-treated pancreatic slices, subcellular particles were isolated by differential centrifugation. Specific activity of $^{14}$C-labeled proteins was determined in subcellular fractions involved in transport and secretion of digestive proteins. CCK-PZ and pentagastrin, used *in vitro*, did not alter the intracellular transport of proteins, although secretion was enhanced. Chronic stimulation of the pancreas with CCK-PZ did not alter the rates of intracellular transport. It is concluded that secretin has no effect on the intracellular transport and secretion of pancreatic macromolecules in acinar cells.

6644 THE EFFECT OF OUABAIN ON ION TRANSPORT ACROSS ISOLATED SHEEP RUMEN EPITHELIUM. *(E.)* Harrison, F. A.; Keynes, R. D.; Rankin, J. C.; Zurich, L. (Agricultural Res. Council Inst. Animal Physiology, Babraham, Cambridge, CB2 4AT England). *J. Physiol.* 249(3):669-677, 1975.

The electrical properties of sheep rumen epithelium were altered by ouabain treatment and changes in the unidirectional and net fluxes of Na, K, and Cl were studied. Epithelial strips were mounted in two identical chambers and bathed in unlabeled Ringer and ouabain solution for 30 min (until tissue and Ringer solution reached equilibrium). In the third 30 min period after ouabain treatment, the net flux of Na from the lumen to the blood side of the epithelium was reduced to zero ($5 \times 10^{-5}$ M or $10^{-4}$ M of ouabain), the net flux of K from the blood to the lumen was reduced from 0.34 to 0.13 μM/cm$^2$/hr ($5 \times 10^{-5}$ M of ouabain), and the net flux of Cl from lumen to blood went from 1.4 to 0.77 μM/cm$^2$/hr ($5 \times 10^{-5}$ M of ouabain). The results suggest the existence of a K and Cl pump which is independent of Na transport in sheep rumen epithelium.

6645 MERCURIAL PERTURBATION OF BRUSH BORDER MEMBRANE PERMEABILITY IN RABBIT ILEUM. *(E.)* Stirling, C. E. (Univ. Washington Sch. Medicine, Seattle, Wash. 98195). *J. Membr. Biol.* 23(1):33-56, 1975.

The effects of organic mercury and p-chloromercuriphenyl sulfonic acid (PCMBS) on amino acid and sugar influx across the brush border, $Na^+$ permeability, and the ileal uptake of $^{203}Hg$-PCMBS were studied *in vitro* using tissues from female New Zealand white rabbits. Both $Hg^{++}$ and PCMBS at mM concentrations reduced the mucosal entry of sugars and amino acids to 80 to 90% of control values within several min. Based on the 50% levels of inhibition, $Hg^{++}$ was 10- and 20-fold more potent than PCMBS in blocking sugar and amino acid influx, resp.; both systems were equally sensitive to $Hg^{++}$. The ileal accumulation of $^{203}Hg$-PCMBS demonstrated a pattern of progressive uptake which showed no tendency toward saturation. This suggested appreciable epithelial entry with prolonged exposures (>30 min at 1 mM). At similar dose levels, $Hg^{++}$ and PCMBS had no significant effect on mucosal $Na^+$ permeability. The inhibition of sugar and amino acid influx was not affected by washes in choline-salt solutions, but dithiothreitol (10 mM) reversed $Hg^{++}$ and PCMBS inhibition by 40 and 100%, resp. Alanine and galactose influx kinetics measured at concentrations of 0 to 100 mM exhibited a linear or diffusional entry component in addition to the usual saturable component for both control and $Hg^{++}$-treated ileum. The presence of a diffusional term in the flux equation resulted in two sets of parameters giving nearly equal fits to these measurements. This ambiguity could be resolved by determining the change in diffusional entry with $Hg^{++}$ treatment. A 20-min exposure to 0.5 mM of $Hg^{++}$ resulted in an increase from 0.050 and 0.045 to 0.064 and 0.070 cm/hr in the coefficient of diffusional entry for alanine and galactose, resp. Thus, $Hg^{++}$ appears to cause a decrease in $J_{max}$ and little change in $K_m$ for both transport mechanisms. This analysis has general bearing on kinetic measurements of transport in which passive fluxes are comparable to those mediated by specific pathways.

6646 ISOOSMOTIC TRANSPORT OF FLUID ACROSS THE HAMSTER SMALL INTESTINE IN THE PRESENCE OF PHLORIZIN-INDUCED INHIBITION OF SUGAR TRANSPORT. *(E.)* Dinda, P. K.; Beck, M.; Beck, I. T. (Hotel Dieu Hosp., Kingston, Ontario, Canada K7L 3H6). *Can. J. Physiol. Pharmacol.* 53(3):375-382, 1975.

The effect of partial inhibition of active glucose transport on isoosmotic transport of fluid was studied in intestinal segments isolated from female hamsters. Each segment was incubated in Krebs-Ringer bicarbonate containing 10 mM of glucose and: 1) no other agent (isotonic control); 2) $5 \times 10^{-5}$ M of phlorizin (isotonic); 3) 50 mM of mannitol (hypertonic control); and 4) 50 mM of mannitol plus $5 \times 10^{-5}$ M of phlorizin (hypertonic). Incubations were carried out for 60 min at 37 C. The absorbate was isoosmotic with the mucosal solution in all groups. The addition of phlorizin to the isotonic mucosal solution caused a reduction in the concentration of glucose in the absorbate (57.7 mM and 37.6 mM, resp., for groups 1 and 2). Isotonic segments had a significantly higher concentration of sodium (121.1 mM) and potassium (4.0 mM) compared to isotonic controls (115.2 mM and 3.2 mM, resp.). The concentration of both glucose and the electrolytes increased in hypertonic solutions. The addition of phlorizin in group 4 caused a decrease in glucose concentration (41.8 mM) compared to the hypertonic control (66.2 mM). The presence of phlorizin or mannitol significantly depressed the potential difference (group 1, 10.7; group 2, 6.4; group 3, 8.9; and group 4, 5.8 mV). Glucose transport/g dry tissue was depressed in group 2 ($p < 0.05$). Glucose, fluid and electrolyte transport were significantly decreased in groups 3 and 4. The magnitude of inhibition in fluid and electrolyte transport produced by mannitol alone (49.2% for fluid, 44.2% for sodium, and 46.5% for potassium) was similar to that produced by mannitol and phlorizin together (44.4, 32.5 and 19.0%, resp.). These data suggest that phlorizin inhibits sodium movement through the electrogenic pathway, but increases the transport of this ion through the electrogenic route. It is further suggested that isoosmotic fluid transport is an inherent property of the small intestine.

6647 A $Na^+$-INDEPENDENT, PHLORETIN-SENSITIVE MONOSACCHARIDE TRANSPORT SYSTEM IN ISOLATED INTESTINAL EPITHELIAL CELLS. *(E.)* Kimmich, G. A.; Randles, J. (Univ. Rochester, Sch. Medicine and Dentistry, Rochester, N.Y. 14642). *J. Membr. Biol.* 23(1): 57-76, 1975.

A monosaccharide transport system in addition to the active $Na^+$-dependent system characteristic of the brush border surface of vertebrate intestinal tissue has been identified in isolated chick (6-8 wk old) intestinal epithelial cells. The accumulation of $^{14}C$-3-O-methylglucose (1 mM) by the isolated cells was studied as a function of time under conditions in which the cells were separated from the incubation medium by centrifugation or millipore filtration. The effects of $Na^+$, D-glucose, phlorizin (10-200 µM), phloretin (10-200 µM), valine (1 mM), leucine (25 mM), fructose, mannose, glucose, and/or 2-deoxyglucose (all sugars at 50 mM) on this accumulation were also studied. The data obtained after separation by centrifugation and millipore filtration were similar. A true unidirectional flux of 3-O-methylglucose in the isolated cells was demonstrated. It was dependent on $Na^+$, inhibited by phlorizin, and inhibited by the inclusion of glucose in the medium. The total $Na^+$-independent 3-O-methylglucose entry rate was inhibited by phloretin in concentrations as low as 10 µM, but this compound had no effect on the $Na^+$-dependent entry system. In contrast, phlorizin had no effect on the $Na^+$-independent system. Phloretin had no effect on the unidirectional flux of valine, although leucine inhibited the entry of valine by 85% under the same conditions. The phloretin-sensitive entry rate was inhibited by glucose and galactose, but not by ketohexose or fructose; xylose and mannose were mildly inhibitory, while 2-deoxyglucose was the most effective inhibitor studied. Phloretin selectively blocked the efflux of sugar from cells which had accumulated sugar to a steady state; thus, a normal steady-state sugar gradient of seven- to eight-fold was transformed to a new steady-state gradient of greater than eight-

fold. The data indicate that the monosaccharide transport system functions only in a facilitative diffusion manner so that it moves monosaccharide across the cell membrane along a downward chemical gradient. The locus of the system is tentatively ascribed to the serosal cell surface, where it would serve for monosaccharide transfer between enterocytes and the lamina propria of the villi.

6648 PYRIDOXINE TRANSPORT ACROSS THE TURTLE, RAT AND RABBIT INTESTINES. *(Eng.)* Hajjar, J. J.; Nassar, K. (Sch. Med., American Univ. Beirut, Beirut, Lebanon). *Comp. Biochem. Physiol.* [*A*] 52: 389-393, 1975.

The intestinal transport of pyridoxine was examined *in vitro* using tissues from fresh-water turtles *(Testudo graeca)*, Sprague-Dawley rats, and rabbits. Turtle and rabbit tissues were mounted between two lucite chambers and equal concentrations of pyridoxine were placed in both the serosal and mucosal solutions; $^{3}$H-pyridoxine was added to one side only and its rate of appearance on the opposite side was measured in the presence and absence of alanine. In other experiments, turtle mucosal strips were incubated for 2 min in solution containing labeled and unlabeled pyridoxine and $^{14}$C-inulin, after which the $^{3}$H and $^{14}$C contents in the tissue and test solution were determined. The steady-state uptake of pyridoxine by turtle, rat and rabbit mucosal strips was simularly determined after 60 min of incubation in labeled and nonlabeled pyridoxine and $^{14}$C-inulin. The mucosal-to-serosal and serosal-to-mucosal fluxes of pyridoxine were equal in the presence of equal low concentrations of pyridoxine in the serosal and mucosal solutions; at higher concentrations, however, the fluxes were not solely explainable on the basis of simple passive diffusion. The unidirectional fluxes of pyridoxine were more than two-fold greater in the turtle than in the rabbit and the fluxes were not influenced by the presence of alanine in the medium. The initial uptake rate of pyridoxine by the turtle mucosal strips was linear with physiological medium pyridoxine concentrations, and curvilinear with concentrations above 5mM. Pyridoxine did not accumulate in the epithelial cells of the turtle, rabbit, or rat intestine. The intracellular to extracellular distribution ratio and low vitamin concentration was close to unity, but at higher concentrations, the intracellular pyridoxine levels remained lower than the extracellular levels in spite of extended incubation periods. Amino acids had no effect on the steady-state uptake of pyridoxine by the epithelial cells in any species. The results indicate that pyridoxine at low concentrations is transported by simple passive diffusion, but that at higher concentrations the vitamin limits its own permeation through the cell membrane. The data do not support the possibility of a complete interdependence between transport of the vitamin and amino acids.

6649 EFFECTS OF SODIUM ON SOLUTE TRANSPORT BETWEEN COMPARTMENTS IN INTESTINAL MUCOSAL EPITHELIUM. *(E.)* Boyd, C. A. R.; Cheeseman, C. I.; Parsons, D. S. (Univ. Oxford, Dep. Biochemistry, South Parks Road, Oxford OX1 3QU, England). *Nature* 256(5520):747-749, 1975.

The effects of sodium on the transfer of solute between compartments in the intestinal mucosal epithelium were studied using a vascularly perfused preparation of frog intestine. Removal of Na from the vascular bed inhibited solute transfer into the blood and decreased the extracellular space. Addition of Na to the vascular perfusate increased the rate of efflux of intracellular 3-O-methyl-D-glucose (3-O-MeG) into the vascular bed. Furthermore, after Na-free perfusion of the lumen and vascular bed, the return of Na to the lumen increased the rate of efflux of 3-O-MeG from the cells into the vascular bed. The total quantity of 'intracellular' 3-O-MeG loaded into the cells from the circulation increased by 43% on addition of Na to the vascular perfusate. When the brush-border amino acid uptake systems were saturated with 10 mM of relevant amino acids, the removal of Na from the vascular perfusate resulted in a large, but reversible inhibition (67%) of the transfer of amino acids initially taken up in the form of peptide into the vascular bed. The uptake of peptide from the intestinal lumen was independent of Na in the lumen. 2-Deoxy-D-glucose (2-DOG) appeared at a faster rate in the effluent from the lumen than 3-O-MeG when the rate of appearance of the two compounds from constant vascular infusion was studied. A pulse of 10 mM glucose in the lumen resulted in a sudden increase in the appearance of both sugars, but the effect was proportionately 5-fold greater for 3-O-MeG. The subsequent addition of phlorizin to the lumen increased the rate of appearance of 3-O-MeG but had no effect on the movement of 2-DOG. It is concluded that in addition to its role in membrane transport, Na also expands extracellular spaces within the intestinal mucosa with consequential effects on the clearance of transported substrates from these spaces. The clearance may be forward into the blood stream or backward into the unstirred layer in the lumen. The requirement for Na for this purpose can be completely filled by its presence in the vascular bed, but only partially fulfilled by the addition of Na to the lumen when Na is absent from the vascular perfusate.

6650 EFFECT OF SUCROSE FEEDING ON THE INTESTINAL TRANSPORT OF SUGARS IN TWO STRAINS OF RATS. *(E.)* Reiser, S.; Michaelis, IV, O.; Putney, J.; Hallfrisch, J. (Nutrition Inst., Agricultural Res. Service, United States Dept. Agriculture, Beltsville, Md. 20705). *J. Nutr.* 105(7):894-905, 1975.

The effect of high-sucrose diets on the rate of intestinal absorption of dietary sugars in Wistar and carbohydrate-sensitive BHE rats was studied. Control rats were fed a stock diet and experimentals, a diet containing 65% sucrose. Determinations were made of immunoreactive insulin from sera obtained after 17 days. After 7-12 weeks of the diet, rats were killed and small intestines and livers were removed. Sucrose-fed rats of both strains showed large and significant increases in the rates of glucose, α-methylglucose, fructose and sucrose transport. The transport of galactose, maltose and lac-

tose did not show consistent increases due to sucrose feeding. Although the magnitude of the increases in sugar transport due to sucrose feeding was only slightly greater in BHE than in Wistar rats, the former tended to exhibit a greater rate of sugar transport when fed either diet. Increases in serum insulin levels were observed in the sucrose-fed rats of both strains and in BHE controls. Lipogenic enzyme activity was greatly increased as a result of sucrose feeding. BHE rats, however, did not show greater levels of enzyme activity than Wistar rats. Liver lipids were increased in both the Wistar and the BHE sucrose-fed rats and in BHE rats fed the stock diet. These data diminish the possibility of a nonspecific transport effect due to differences in the availability of nutrients from either the stock or the sucrose diets.

6651 TRANSMUCOSAL TRIGLYCERIDE TRANSPORT RATES IN PROXIMAL AND DISTAL RAT INTESTINE IN VIVO. *(E.)* Wu, A.; Clark, S. B.; Holt, P. R. (Saint Luke's Hosp. Center, New York, N.Y. 10025). *J. Lipid Res.* 16(4):251-257, 1975.

Direct measurements of fractional triglyceride output rates in proximal and distal intestine, using direct regional perfusion under conditions where uptake from the lumen was complete, were utilized to test a mathematical model of lipid uptake rates. Male Wistar rats received four cannulas: abdominal thoracic duct for lymph collection; bile and pancreatic juice diversion; and two intraintestinal infusion cannulas inserted into either the duodenum (proximal) or the intestinal midpoint (distal). Infusion of donor bile and pancreatic juice (0.75 ml/hr) was begun immediately after surgery and was continued without interruption. A continuous infusion of glucose-KCl-NaCl was also administered (2.293 ml/hr for 24 hr, then 1.146 ml/hr), except during lipid infusion. Infusions of [$^{14}$C]triolein (1.146 ml/hr) were made for 6 hr, 48 and 72 hr after surgery. The total recovery of [$^{14}$C]triolein in both proximal and distal groups was more than 90% on both days. The proximal output rate reached a steady state at 3 hr after the start of infusion and plateaued at 98% of the infusion rate. Output from the distal intestinal wall was much slower initially and leveled off at 85% after 5 hr of infusion. Absorption from the lumen approached 100% in both proximal and distal intestine when measured at 3 and 6 hr. The mean half-life for the distal intestine was about 35% greater than that for the proximal intestine. The total $^{14}$C-labeled lipid accumulated in the intestinal wall at the end of the 6-hr infusion period was greater in distally infused animals (22.3% of the total infused lipid compared to 13.9% in proximal intestine). Thin-layer chromatography of the tissue [$^{14}$C]lipid showed more than 90% of the label was in triglyceride in both proximal and distal intestine. The fractional turnover rate of the labeled lipid through the intestinal wall *in vivo* was about 40% slower in distal compared with proximal halves of rat intestine. These data support previous findings suggesting that slower distal transmucosal lipid transport is responsible for the higher tissue lipid accumulation in distal compared with proximal intestine when uptake rates are maximal.

6652 BILE CONSTITUENTS IN BLOOD AND LYMPH DURING BILIARY OBSTRUCTION. I. THE DYNAMICS OF ABSORPTION AND TRANSPORT OF IONS AND COLLOID MOLECULES. *(E.)* Szabo, G.; Magyar, Z.; Jakab, F. (Pharmacological Res. Inst., H-1430 Budapest, Hungary). *Lymphology* 8(2):29-36, 1975.

An analysis of the transport of bile constituents was made by the introduction of known amounts of Na$^{125}$I and $^{131}$I-albumin into the biliary tract at a constant rate. The iodide ion (5 µCi) and labeled albumin (5 µCi) were infused into mongrel dogs *via* the common bile duct at pressures of 20 to 25 and 40 mm Hg, at rates of 0.1 to 0.3 or 1.1 ml/min. One group of dogs also received a single i.v. injection of the iodide ion (5 µCi). At 40 mm Hg, the amounts of the iodide ion and the labeled albumin were 73% and 68%, resp. At 25 mm Hg, the difference between ion transport and colloid molecule transport increased: values were 80% for the iodide ion and 52.5% for the labeled albumin. At 40 mm Hg, the lymphatic concentration of labeled albumin reached 36% of its concentration in the infusion fluid. It is concluded that at increased pressure fluid leaks first from the biliary ducts into the Mall's spaces. Due to water absorption and ion and small molecule diffusion into the capillaries, the concentrations of proteins or protein-bound molecules in this part of the hepatic interstitial fluid increases, reflected in their high concentration in the lymph. If bile pressure rises further, fluid also leaks into the spaces of Disse, leading to a bulk flow of solvent and solutes into the sinusoids and to the near disappearance of differences in the venous transport of ions and colloids.

6653 BILE CONSTITUENTS IN BLOOD AND LYMPH DURING BILIARY OBSTRUCTION. II. THE ABSORPTION AND TRANSPORT OF BILE ACIDS AND BILIRUBIN. *(E.)* Szabo, G.; Magyar, Z.; Szentirmai, A.; Jakab, F.; Mihaly, K. (Pharmacological Res. Inst., H-1430, Budapest, Hungary). *Lymphology* 8(2):36-42, 1975.

An attempt was made to calculate the absolute amounts of bile acids transported by the lymphatic and venous routes. Total bilirubin and bile acid concentrations were made in mongrel dogs who had received a cannula in the thoracic duct, as well as cystic and common bile duct ligation. Lymph samples were collected for 8 hr in 2-hr periods, and subsequently up to 24 hr in two 8-hr periods. Lymphatic concentrations of both bilirubin and bile acids attained maximum levels between the fourth and sixth hr (4.82 mg% for bilirubin, while the normal value was 0.20 mg%; 116 µM/l for bile acids, while the normal value was 1 µM/l). Lymphatic concentrations remained above plasma concentrations during the whole 24 hr. The amounts of both substances transported by the lymph system rose steadily for 6 and 8 hr, resp., and after 2 hr of occlusion they exceeded the amounts transported by the venous system. From these data it is suggested that in the first hr after biliary occlusion, the concentration of bilirubin and especially that of bile acid in the interstitial fluid of the liver is near the maximal binding capacity of the proteins present in the same fluid.

6654 DIABETES MELLITUS: CHANGES IN THE TRANSPORT PROPERTIES OF ISOLATED INTESTINAL MICROVILLOUS MEMBRANES. *(E.)* Hopfer, U. (Dept. Biochemistry, Federal Inst. Technology, Zurich, Switzerland). *Proc. Nat. Acad. Sci. USA* 72(6):2027-2031, 1975.

The transport properties of the luminal plasma membranes of small intestinal epithelial cells from normal and diabetic rats were compared. Jejunal and ileal mucosal samples were isolated from rats killed 4-8 days after injection with alloxan (50 mg/kg) or saline solution (control). Accumulation of D-glucose was greater in diabetic membrane segments with the addition of NaCl or NaSCN (1.5 and 2.0, resp., measured as the ratio of maximum over equilibrium uptake of D-glucose) compared with controls (1.1 and 1.4, resp.). Increasing the glucose-independent $Na^+$-conductance of the membrane with monactin (50% ethanolic solution) or gramicidin D reduced the active accumulation of D-glucose by membrane preparations from both control and diabetic rats. Concentrations of both ionophorous antibiotics in the incubation medium of diabetic membrane vesicles could be adjusted so that D-glucose transport was indistinguishable from control membranes not treated with ionophores. It is suggested that the microvillous membranes are a site for the changes which occur in diabetes mellitus. It is further suggested that the change in transport properties of the isolated membranes may explain the simultaneous elevation of active intestinal sugar, amino acid and bile salt transport in intact intestinal tissue.

6655 JEJUNAL AND ILEAL ABSORPTION OF DIBASIC AMINO ACIDS AND AN ARGININE-CONTAINING DIPEPTIDE IN CYSTINURIA. *(E.)* Silk, D. B. A.; Perrett, D.; Clark, M. L. (Saint Bartholomew's Hosp., London, England). *Gastroenterology* 68(6):1426-1432, 1975.

Jejunal perfusion studies with an arginine-containing dipeptide, L-arginyl-L-leucine, were performed in cystinuric patients and normal controls to evaluate the role of the specific dibasic amino acid transport system. Amino acid absorption from the jejunum and ileum of six male homozygous cystinuric patients was assessed and the results were compared with those obtained in sex- and age-matched controls. Solutions containing either glycine (4.2 mM) plus lysine (4.2 mM) or arginine (1 mM) plus leucine (1 mM) were perfused. Jejunal absorption of L-arginyl-L-leucine was also investigated by perfusion of 1 mM in the jejunum of patients and controls. Both jejunal and ileal absorption of glycine and L-leucine were normal in patients compared to controls, but there was severe impairment ($p < 0.001$) during jejunal and ileal perfusion with L-lysine and L-arginine. The rates of uptake of both L-arginine and L-leucine were similar in both patients and controls during perfusion with the dipeptide. Higher concentrations of L-arginine were detected during perfusion with the dipeptide in cystinuria patients (26.7 μM/100 ml) compared with controls (7.6 μM/100 ml). These data suggest a defect of specific carrier-mediated transport of the dibasic amino acids throughout the whole of the small intestine in patients with cystinuria. It is concluded that specific amino acid transport systems may play an important role during intestinal transport of peptides.

6656 REGIONAL DIFFERENCES IN OXALATE ABSORPTION BY RAT INTESTINE: EVIDENCE FOR EXCESSIVE ABSORPTION BY THE COLON IN STEATORRHEA. *(E.)* Saunders, D. R.; Sillery, J.; McDonald, G. B. (Dep. Medicine, RG-20, Univ. Washington, Seattle 98195). *Gut* 16(7):543-548, 1975.

To elucidate the pathogenesis of enteric hyperoxaluria, the effects of bile salts, calcium, and long-chain fatty acid on the absorption of oxalate and water by the rat intestine were studied *in vivo* using fasted male Sprague-Dawley rats. The animals were anesthetized and jejunal, ileal, and colonic sections were created. The jejunal segments were in the proximal 50 cm of the small intestine; the ileal segments extended orad from a point 5 cm from the ileocecal junction, and the colonic segments were distal to the cecum. Absorption was measured under steady-state conditions during single pass infusions, each intestinal segment serving as its own control. In the jejunum, taurocholate (10 mM), the principle salt in rat bile, depressed the absorption of both oxalate and water. Absorption was not depressed further by $Ca^{++}$ (1 mM) or linoleic acid (2 mM). In the ileum, taurocholate did not inhibit absorption, but linoleic acid depressed the absorption of both oxalate and water. In the colon, taurocholate decreased the absorption of both substances; linoleic acid further depressed the net water transport, but it enhanced the absorption of oxalate. Calcium negated the inhibitory effect of linoleic acid on water transport and the stimulative effect of linoleic acid on oxalate absorption. When a lower concentration of taurocholate (2.5 mM) was infused into the colon, net water transport and oxalate absorption were unaffected by calcium or linoleic acid with calcium. Linoleic acid without calcium depressed net water transport but did not inhibit oxalate absorption. It is concluded that long-chain fatty acids may enhance the absorption of oxalate from the rat colon, an observation which may be relevant to understanding the process of hyperoxaluria in patients with steatorrhea.

6657 EFFECT OF CHANGES IN FEEDING SCHEDULE ON THE DIURNAL RHYTHMS AND DAILY ACTIVITY LEVELS OF INTESTINAL BRUSH BORDER ENZYMES AND TRANSPORT SYSTEMS. *(E.)* Stevenson, N. R.; Ferrigni, F.; Parnicky, K.; Day, S.; Fierstein, J. S. (Rutgers Medical Sch., Piscataway, N.J. 08854). *Biochim Biophys. Acta* 406(1):131-145, 1975.

The diurnal rhythms and daily activity levels of the intestinal glucose-galactose transport, lactase, maltase, sucrase, trehalase, γ-glutamyltransferase, alkaline phosphatase, and leucylnaphthylamide-hydrolyzing systems were studied in male Sprague-Dawley rats maintained on *ad libitum* and restricted (to the period from 2:00 to 4:00 pm daily) feeding regimens. Lighting was constant during the experimental period. The

animals were killed at specific times during the seventh day of the study. The protein content of the intestinal mucosal homogenates showed no diurnal rhythmicity and did not vary according to feeding regimen. The various enzymes and transport systems tended to show higher activities at various times between 12:00 P.M. and 12:00 A.M. in the *ad libitum* group, while lower activities occurred at various times between 11:00 A.M. and 9:00 P.M. Leucylnaphthylamide-hydrolyzing activity was reduced until 12:00 A.M. and lactase activity was reduced until 3:00 A.M. In general, there was a 12-hr shift in the activity patterns between the *ad libitum* group and the restricted group. In the latter, higher activity was observed between 12:00 A.M. and 9:00 P.M. for all systems except alkaline phosphatase, which was highest from 6:00 P.M. to 3:00 A.M. Lower activity occurred between 12:00 A.M. and 2:00 P.M. for all systems except the leucylnaphthylamide-hydrolyzing system, which was lower from 3:00 A.M. to 9:00 P.M., and alkaline phosphatase, which was lower from 5:00 A.M. to 5:00 P.M. In comparison with the *ad libitum* group, the restricted group showed decreased leucylnaphthylamide-hydrolyzing activity, similar alkaline phosphatase activity, and increased activities in all other systems. Thus, at certain times of the day, the enzyme and transport system activities were similar in the *ad libitum* and restricted groups, while at other times the activities differed by as much as 341%. The data indicate that correlations between diet and intestinal enzyme or transport activity level can be made with confidence only after both the entire diurnal rhythmicity pattern and the mean daily activity levels have been determined.

6658 THE INFLUENCE OF 2,4-DINITROPHENOL AND L-METHIONINE ON THE CHARACTERISTIC DYNAMICS OF IN VITRO INTESTINAL TRANSPORT OF HISTIDINE. *(It.)* Brucoli, E.; Ceriani, T.; Garbagnati, F.; Schmid, R.; Stefanelli, M.; Ventura, U. (Inst. Human Physiology, Univ. Pavia, Pavia, Italy). *Boll. Sper. Ital. Biol. Sper.* 50(19):1615-1621, 1974.

6659 INTESTINAL ABSORPTION OF β-ESSCINE. *(Ger.)* Eisenburger, R.; Hampel, H.; Hofrichter, G.; Liehn, H. D. (Forschungs laboratorium, Chemisch-Pharmazeutische Fabrik Adolf Klinge & Co., Munich, Germany). *Arzneim. Forsch.* 24(10):1621-1624, 1974.

6660 A TECHNIQUE FOR STUDYING INTESTINAL ABSORPTION AND GUT WALL METABOLISM. *(E.)* Weber, F. L.; Maddrey, W. C.; Walser, M. A.; Hendrix, T. R. (John's Hopkins Univ. Sch. Med., Baltimore, Md.). *Gastroenterology* 68(4):1010, 1975.

6661 IMPORTANCE OF $CA^{2+}$ AND $MG^{2+}$ DURING ABSORPTION OF MICELLAR LIPIDS BY INTESTINE IN VITRO. *(E.)* Strauss, E. W. (Div. Biol. Med. Sci., Brown Univ., Providence, R. I.). *Gastroenterology* 68(4):992, 1975.

6662 INTESTINAL UPTAKE OF GLUCOSE IN PARENTERALLY NOURISHED RATS. *(E.)* Schanbacher, L. M.; Copeland, E. M.; Dudrick, S. J.; Johnson, L. R.; Castro, G. A. (Univ. Texas Med. Sch., Houston, Tex.). *Gastroenterology* 68(4):981, 1975.

6663 MODIFICATION OF PERMEABILITY PROPERTIES OF GASTRIC ANTRUM. *(E.)* Bajaj, S.; Spenney, J. G.; Sachs, G. (Univ. Alabama, Birmingham, Ala.). *Gastroenterology* 68(4):978, 1975.

6664 EFFECT OF ASPIRIN ON CHOLERA TOXIN-STIMULATED INTESTINAL ELECTROLYTE TRANSPORT. *(E.)* Powell, D. W.; Farris, R. K. (Dep. Med., Univ. North Carolina, Chapel Hill, N.C.). *Gastroenterology* 68(4):968, 1975.

6665 EFFECT OF THYROCALCITONIN ON RABBIT JEJUNAL AND ILEAL $H_2O$ AND ELECTROLYTE TRANSPORT. *(E.)* Kisoff, B.; Moore, E. W. (Virginia Commonwealth Univ., Richmond, Va.). *Gastroenterology* 68(4):960, 1975.

6666 EFFECTS OF DIABETES ON DUODENAL AND ILEAL STRONTIUM ABSORPTION IN THE RAT. *(E.)* Miller, D. L.; Schedl, H. P. (Dep. Med., Univ. Iowa, Iowa City, Iowa). *Gastroenterology* 68(4):956, 1975.

6667 THE RELATIONSHIP BETWEEN STARLING FORCES, REGIONAL BLOOD FLOW AND $N_a$ AND $H_2O$ FLUXES IN THE CANINE ILEUM. *(E.)* Mailman, D.; Jordon, K. (Dep. Biol., Univ. Houston, Houston, Texas). *Gastroenterology* 68(4):939, 1975.

6668 CARRIER-MEDIATED TRANSPORT OF BILE ACIDS BY THE LIVER. *(E.)* Reichen, J.; Paumgartner, G. (Dept. Clinical Pharmacology, Univ. Berne, CH-3010 Berne, Switzerland). *Experientia* 31(6):714, 1975.

6669 INHIBITION OF SODIUM AND SODIUM-COUPLED TRANSPORT BY HARMALINE IN THE INTESTINE IN VITRO. *(E.)* Sepulveda, F. V.; Robinson, J. W. L. (Hopital Cantonal, CH-1011 Lausanne, Switzerland). *Experientia* 31(6):714-715, 1975.

6670 THE GASTROINTESTINAL ABSORPTION OF ASPIRIN. INFLUENCE OF ASCORBIC ACID IN HUMANS. *(E.)* Oriani, G. A.; Blanco, C. Del V.; Galmuzzi, G. Giuliani, E.; Colombo, B. M. (Medical Dept., Richardson-Merrell S.p.A., Naples, Italy). *Clinical Trials Journal* 11(2):110-115, 1974.

6671 EFFECT OF SURFACTANTS ON ABSORPTION THROUGH MEMBRANES III. EFFECTS OF DIOCTYL SODIUM SULFOSUCCINATE AND POLOXALENE ON ABSORPTION OF A POORLY ABSORBABLE DRUG, PHENOLSULFONPHTHALEIN, IN RATS. *(E.)* Malik, S. N.; Canaham, D. H.; Gouda, M. W. (Sch. of Pharmacy, Univ. Montana, Missoula, MT 59801). *J. Pharm. Sci.* 64(6):987-990, 1975.

6672 EFFECT OF SURFACTANTS ON ABSORPTION THROUGH MEMBRANES IV: EFFECTS OF DIOCTYL SODIUM SULFOSUCCINATE ON ABSORPTION OF A POORLY ABSORBABLE DRUG, PHENOLSULFONPHTHALEIN, IN HUMANS. *(E.)* Khalafallah, N.; Gouda, M. W.; Khalil, S. A. (Faculty of Pharmacy, Univ. of Alexandria, Alexandria, Egypt). *J. Pharm. Sci.* 64(6):991-994, 1975.

See also, 6606, 6613, 6814, 6925, 6926, 6944, 7918.

## MOTILITY

6673 LONGITUDINAL CONTRACTIONS IN THE DUODENUM: THEIR FLUID-MECHANICAL FUNCTION. *(E.)* Melville, J.; Macagno, E.; Christensen, J. (Iowa Inst. Hydraulic Res., Iowa City, Iowa 52242). *Am. J. Physiol.* 228(6):1887-1892, 1975.

The hypothesis that contractions of the longitudinal muscle layer occur in the duodenum independently of those of the circular muscle layer and that these contractions induce the flow of the duodenal contents was investigated. Segments of duodenum were removed from healthy adult opossums of both sexes and immersed in a bath of Krebs solution with the ends tied to horizontal glass tubes. The segments were photographed during periods of longitudinal muscle contraction when the circular muscle layer appeared inactive. Relative displacements as a function of time were determined based on the movement of India ink spots on the serosal surface. The frequency and velocity of the duodenal slow waves were also recorded under normal illumination and during exposure to high-intensity photography lamps. The frequency of longitudinal oscillation of the marked points on the duodenal segments was 20.5 cycles/min, the longitudinal displacement wave spreading caudad with an average velocity of 3.27 cm/sec. The slow wave frequency in the segments was 17.9 cycles/min with a propagation velocity of 1.63 cm/sec under normal illumination. Under the high-intensity lamps, the frequency increased to 18.9 cycles/min. In a 2-dimensional mechanical model, flow induced by simulated longitudinal contractions was visualized and a theoretical model of axisymmetric flow was made. Based on this model, it is concluded that independent contractions of the longitudinal muscle layer appear driven by the electrical slow waves of the duodenum and that they are capable of inducing a pattern of flow in which the duodenal contents flowed between the core and the periphery of the intestinal conduit.

6674 ULTRADIAN RHYTHMS IN WAKING GASTRIC ACTIVITY. *(E.)* Hiatt, J. F.; Kripke, D. F. (Narcotic Treatment Program, 1300 Market St., San Diego, Calif. 92101). *Psychosom. Med.* 37(4):320-325, 1975.

Ultradian rhythms in waking gastric activity were studied in six female and five male young adult volunteers. The subjects were fasted and nasogastric tubes with rubber balloons on the end were inserted to monitor gastric contractions. The electroencephalogram (EEG), electrooculogram (EOG), and electromyogram (EMG) were monitored by a multiplex telemetry transmitter worn in a special cap. The intraluminal gastric pressure records over the 8-hr experimental session showed a tendency for periods of intense gastric contraction to recur at regular intervals. The typical subject showed 4 to 5 cycles in the 8-hr period. The intense contraction periods within these cycles lasted about 18 min and were characterized by an increase in the peak pressure of individual contractions and increases in baseline pressure between contractions. The contraction periods were preceded by gradually increasing activity followed by an abrupt decrease. Although the modal duration of a cycle was 100 min, the cycle was about 200 min in three subjects. There was a tendency for those subjects with elevated scores on the Minnesota Multiphasic Personality Inventory to show poor or absent (12 to 18 cycles/day) rhythms in the gastric recordings. The degree of rhythmicity was inversely correlated with paranoia scores and positively correlated with scores on the Goldberg Scale, which distinguishes psychotic from neurotic processes. The ultradian cycle observed in the waking subjects bore a striking resemblance to previously recorded sleep cycle patterns. The data combined with previous data suggest that both appetitive and consummatory aspects of alimentary function may display ultradian rhythms.

6675 THE INTRINSIC INNERVATION OF THE HUMAN ALIMENTARY TRACT AND ITS RELATION TO FUNCTION. *(E.)* Bennett, A.; Stockley, L. (King's Coll. Hosp. Medical Sch., London, England). *Gut* 16(6):443-453, 1975.

The intrinsic innervation of the human gut was studied in strips of circular and longitudinal muscle removed form various regions of the alimentary canal at operation. The strips, all free of the effects of drugs used at surgery, were electrically stimulated (0.1-12 Hz) with square-wave pulses of alternating polarity generated by linked stimulators. Specimens of lower esophogeal smooth muscle were obtained from eight patients; 14 circularly cut strips varied in response, generally contracting at 0.1-0.5 Hz, while 10 longitudunal muscle strips were predominantly contracted by electrical stimulation, optimally at 4 Hz. In 52 specimens of gastric body and antrum, electrical stimulation usually elicited contractions which increased as the frequency was raised. Specimens of terminal ileum proximal to the ileocaecal spincter (15 patients) showed circular muscle contracted at 0.1-0.5 Hz, and longitudinal contractile

responses at 1-64 Hz. The responses of nine specimens of ascending colon were similar to those reported for the sigmoid colon. Variations, most pronounced at 4 Hz, illustrated a clear gradient of response from the stomach to colon in the longitudinal muscle, with excitation dominant proximally and inhibition dominant distally. The neuronal nature of the response to electrical stimulation was tested with tetrodoxin plus a variety of other drugs, including hexamethonium bromide, KCl, $BaCl_2$, acetylcholine perchlorate, atropine, and hyoscine. The esophogeal responses showed that both layers receive excitatory and inhibitory innervation, with cholinergic excitation generally predominating in the distal longitudinal layer. In the stomach, cholinergic contractions converted to nonadrenergic relaxations in the presence of hyoscine. The unresponsiveness of the gastric body circular muscle was attributed to its insulated anatomy. Types of responses in the ileum suggested both adrenergic and nonadrenergic inhibitory nerves, dependent on the type of stimulation. Although gut motility may also be affected by locally released substances or circulating hormones, it is suggested that electrical slow wave activity and the intrinsic innervation are fundamental for the control of normal gut activity. Both revealed gradients down the gut relating to regional differences in function.

6676 THE VAGUS, THE DUODENAL BRAKE, AND GASTRIC EMPTYING. *(E.)* Shahidullah, M.; Kennedy, T. L.; Parks, T. G. (Dep. Surg., Queen's Univ., Belfast, Northern Ireland). *Gut* 16(5):331-336, 1975.

The site of duodenal receptors regulating gastric emptying rates was investigated, and the role of the vagus in the regulation of gastric emptying with an intact pylorus was also studied. Gastric emptying studies were carried out before and after vagotomy on two groups of dogs with gastric and duodenal fistulas produced by inserting Gregory cannulas into the stomach and duodenum, resp. The gastroduodenal junction was left intact in the first group, but in the second the pylorus was implanted end-to-side 50 cm further down the small intestine. Five dogs in the first group underwent truncal vagotomy and two dogs in the second group underwent extragastric selective vagotomy. In emptying studies performed 6 to 10 weeks after preparation of fistulas, 600 ml of fluids were used in seven dogs with an intact gastroduodenal junction. The rate of emptying of different instillates varied greatly, with mean emptying times of: deionized water, 44 min; hydrochloric acid, 85 min; dextrose, 126 min; and fat, 144 min. After truncal vagotomy the emptying time for each instillate became significantly longer, but the proportional differences were maintained. In eight dogs with the pylorus implanted into the small intestine, emptying studies utilized 500 ml of different substances introduced into the stomach with 100 ml of deionized water through the duodenal cannula. With water in the duodenum, different instillates emptied from the stomach at similar rates. In four of these dogs, 500 ml of water was instilled into the stomach and 100 ml of different instillates were introduced into the duodenum, resulting in the following mean emptying times: water, 54 min; 250 mM HCl, 80 min; 10% dextrose, 137 min; and 5% fat, 160 min. In two dogs after extragastric selective vagotomy, the rate of emptying of water, dextrose, and fat were similar. These studies indicate that most, if not all, the duodenal braking receptors lie in the proximal 50 cm of the small intestine. It is concluded that vagal innervation of the stomach in dogs is important in gastric emptying, but duodenal innervation is not essential for the function of the braking receptors which appear to work through a hormonal mechanism.

6677 CONTROL OF THE INTERDIGESTIVE MYOLECTRIC ACTIVITY IN DOGS BY THE VAGUS NERVES AND PENTAGASTRIN. *(E.)* Marik, F.; Code, C. F. (Mayo Clinic, Rochester, Minn.). *Gastroenterology* 69(2): 387-395, 1975.

The effects of vagotomy and pentagastrin on the interdigestive complex were studied in eight healthy, conscious, fasted female mongrel dogs. The electrical activity of the stomach and small intestine were recorded using surgically implanted monopolar electrodes, and the normal characteristics of the interdigestive myoelectric complex were determined in each dog. The electrical activity of the complex was then recorded during the i.v. infusion of pentagastrin (0.1 µg/kg/min for 10-150 min beginning at various phases during the cycle of the complex), after vagotomy, and during pentagastrin infusion after vagotomy. In intact dogs, pentagastrin infusion interrupted that interdigestive myoelectric complex in the stomach and small intestine and replaced it with activity which closely resembled that seen after feeding. After bilateral transthoracic vagotomy, pentagastrin still interrupted the complex. However, a premature activity front (phase III) of the complex was initiated in the stomach and duodenum after the cessation of pentagastrin infusion; this activity migrated in a normal fashion distally along the small bowel. Vagotomy was also followed by a reduction in the temporal regularity of the cycles of the complex. Fewer cycles/10 hr occurred in most dogs after vagotomy than before surgery, and the complexes were not as regularly interrupted by feeding a small meal (50 g meat) as they had been before vagotomy. The results indicate that both neural and hormonal influences have a role in controlling the interdigestive motor complex in dogs.

6678 INFLUENCES ON COLONIC AND SMALL INTESTINAL MOTILITY BY THE CEREBELLAR FASTIGIAL NUCLEUS. *(E.)* Martner, J. (Dept. Physiology, Univ. Goteborg, Sweden). *Acta Physiol. Scand.* 94(1):82-94, 1975.

The fastigial influence on intestinal motility was investigated in acute experiments on chloralosed cats of both sexes. In most animals, the adrenals were ligated and i.v. hydrocortisone (10 mg/kg) was given. Arterial pressure was recorded through a femoral catheter and intestinal motility was recorded in isolated small intestinal and colonic segments, those portions of the small intestine not being used for recording being extirpated, along with the spleen and greater omentum. The vagal and pelvic nerves were dissected and placed on ligatures. Intestino-

intestinal inhibitory reflexes were elicited by graded distention of a small isolated intestinal loop or by afferent stimulation of thin mesenteric pedicles. For baroreceptor stimulation, one carotid sinus region was isolated and perfused with femoral artery blood and topical cerebellar stimulations were induced by the Horsley-Clarke technique. After each experiment, the cerebellum and adjacent brainstem structures were examined histologically. Electrical stimulation of the rostral fastigial pole produced a rise in blood pressure, increased motor activity in the ileum and colon, and increased and decreased motility responses in the jejunum. The intestinal responses were neither secondary to changes in intestinal blood flow nor to baroreceptor reflexes induced by the increased blood pressure. The excitatory responses were not due to increased parasympathetic activity since sectioning of such pathways failed to abolish the responses. Interruption of adrenergic sympathetic discharge did, however, eliminate these responses, indicating that the fastigial effects were mediated by the suppression of the prevailing adrenergic tone. Noxious stimuli to the abdomen, including laparotomy, inhibited intestinal motility by a reflex increase in adrenergic discharge. It is suggested that the fastigial influence on intestinal motility is due primarily to suppression of this reflex.

6679 INFLUENCES ON THE DEFECATION AND MICTURITION REFLEXES BY THE CEREBELLAR FASTIGIAL NUCLEUS. *(E.)* Martner, J. (Dept. Physiology, Univ. Goteborg, Sweden). *Acta Physiol. Scand.* 94(1):95-104, 1975.

The influence of the cerebellar fastigial nucleus on the defecation and micturition reflexes was studied in chloralosed cats. The Horsely-Clarke technique was used for cerebellar stimulation and the defecation reflex was elicited by afferent stimulation of one cut pelvic nerve or by application of mechanical friction to the rectal mucosa. The small intestine, spleen, and greater omentum were extirpated and in most animals the adrenals were ligated, adrenocortical substitution being given by i.v. hydrocortisone. Catheters were used to record arterial pressure and bladder and colonic motilities were recorded from an isolated perfused proximal colonic loop. Gallamine iodide, guanethidine, bidenzyline, phentolamine, propranolol, and/or atropine were given i.v. in some experiments. Whenever effective, topical fastigial stimulation regularly suppressed both the somatomotor and autonomic components of the defecation reflex; the straining movements and the colonic vasodilatator and motor responses associated with defecation were completely inhibited. Bladder motility could be either suppressed or enhanced, depending on the prevailing bladder tone and on the fastigial site stimulated. The autonomically conveyed inhibitory responses were in both cases independent of the adrenergic sympathetic pathways, since both were unaffected by sympathetic nerve sectioning and by adrenergic blocking drugs, but were eliminated by pelvic nerve section. It is suggested that these fastigial inhibitory influences are exerted on the spinal parasympathetic reflexes controlling both bladder and colon. The rostral ventromedial fastigial pole appears to be involved in sympathetic and parasympathetic autonomic mechanisms, affecting both bladder responses and the defecation reflex.

6680 THE MUCOSAL LINING OF THE INTRAMURAL COMMON BILE DUCT AS A DETERMINANT OF DUCTAL OPENING PRESSURE. *(E.)* Tansy, M. F.; Salkin, L.; Innes, D. L.; Martin, J. S.; Kendall, F. M.; Litwack, D. (Temple Univ. Health Sciences Center, 3223 North Broad St., Philadelphia, Pa. 19140). *Dig. Dis.* 20(7):613-625, 1975.

Histological evidence was sought for the presence of ductal mucosal folds in the intramural portion of the common bile duct of the pigeon, rabbit, cat, dog and human. Common bile duct samples from all species were specifically stained with hematoxylin and eosin and examined microscopically. In other experiments, norepinephrine, histamine, and bethanechol were administered intraductally or i.v. to cats and dogs and the effects on the systemic arterial blood pressure and opening pressures of the choledochoduodenal junction were studied. Structural studies in dogs were also undertaken to compare the luminal topographies of the intramural and extramural portions of the common bile duct. The lumen of the intraduodenal portion of the common bile duct was almost completely filled by folds of a highly vascularized mucosa in all five species studied. These folds were most apparent near the intraduodenal ductal orifice, where they almost completely occluded the lumen. Histological studies in dogs indicated that the mucosal topographies of the extramural and intramural portions of the duct were markedly different. The physiological data in dogs and cats indicate that changes in the systemic arterial blood pressure were associated with changes in the opening pressures of the choledochoduodenal junction; these changes varied in the same direction. The bile duct opening pressures in these two species were increased by the intraductal administration of histamine and were reduced by intraductal norepinephrine. When given i.v., the effects of these drugs were the opposite of those produced by intraductal treatment; however, the secondary effects after i.v. treatment were the same as the effects after intraductal treatment. Histological examination of the intraductal folds subsequent to intraductal histamine revealed a marked vascular engorgement. It is concluded that the most significant determinant of changes in the ductal opening pressures in the cat and dog is probably the state of the mucosal vasculature within the terminal portion of the common bile duct.

6681 INTRALUMINAL AND INTRAPERITONEAL PRESSURES AT THE CARDIA: EFFECT OF HORMONES AND SURGICAL INTERVENTION. *(E.)* Moossa, A. R.; Cooley, G. R.; Skinner, D. B. (Univ. Chicago Hosp. Clinics, Ill.). *Surg. Forum* 24:370-372, 1974.

The effects of hormonal administration, fundic excision, and esophagogastrectomy on the intraluminal and extraluminal pressures in the cardia were studied in Rhesus monkeys. Six refluxing and six nonrefluxing monkeys were given pentagastrin, secretin, and cholecystokinin (CCK-PZ) at varying rates by i.v. infusion

or s.c. injection; the intraluminal and extraluminal pressures were monitored by surgically placed catheters. The refluxers were those whose esophageal pH at 3 cm above the intraluminal high-pressure zone at the cardia fell to below 4 at any time during a 5-day study. Fundic excision was performed on two non-refluxers and esophagogastrectomy was performed on three more nonrefluxers; the effects of the gastrointestinal hormones were also assessed in the latter animals. The extraluminal pressures at the cardia correlated much better with gastroesophageal reflux than did the intraluminal pressures. The gastrointestinal hormones had a variable effect on the intraluminal pressures but did not influence the extraluminal pressures or reflux. It is concluded that external factors other than the angle of His are more important in preventing reflux than any true sphincter under hormonal control.

6682 THE EFFECTS OF PREMEDICATION DRUGS ON THE LOWER OESOPHAGEAL HIGH PRESSURE ZONE AND REFLUX STATUS OF RHESUS MONKEYS AND MAN. *(E.)* Hall, A. W.; Moossa, A. R.; Clark, J.; Cooley, G. R.; Skinner, D. B. (Pritzker Sch. Med., Univ. Chicago, Ill.). *Gut* 16(5):347-352, 1975.

The effects of morphine sulfate (7-10 mg for humans; 1 mg for monkeys), pethidine hydrochloride (40-50 mg, humans; 5-7 mg, monkeys), and diazepam (2.5-10 mg, humans; 0.5-1 mg, monkeys) on the high pressure zone and the reflux status of Rhesus monkeys and man were studied. Esophageal motility was studied by standard manometry in 35 fasting human volunteers and in eight fasting monkeys. The high pressure zone in man was measured as the difference between the end expiratory intragastric pressure and the mean peak pressure in the lower esophagus. In monkeys, the mean intragastric value was subtracted from the mean of the peak lower esophageal pressure. Gastrointestinal reflux was measured using a Beckman intestinal pH electrode which was passed *via* the nostril until it lay in the lower esophagus. The high pressure zone pressure decreased significantly in man after morphine (42.3%) and pethidine (51.61%), and almost significantly after diazepam (35.42%). The reductions in high pressure zone pressures were significant in monkeys after all three drugs (46.3, 52.4, and 59.2% for morphine, pethidine, and diazepam, resp.). Significant reflux, as measured by a score greater than 2 of 20 (reflux in all positions tested), was seen in 14 humans, and injection of drugs increased the numerical reflux score by a mean of 6.35. Drug injection caused reflux (mean, 9.7) in 13 (59%) of 22 subjects who did not reflux on control testing. In monkeys, the relation between the high pressure zone and reflux status depended on the numerical value of the high pressure zone pressure. It is concluded that great caution must be exercised in the administration of these drugs in doses sufficient to cause drowsiness in subjects who will not be under constant skilled supervision, due to the increased risk of regurgitation and pulmonary aspiration.

6683 EFFECT OF NICOTINE ON THE LOWER ESOPHAGEAL SPHINCTER. STUDIES ON THE MECHANISM OF ACTION. *(E.)* Rattan, S.; Goyal, R. K. (Univ. Texas Health Science Center, Dallas, Tex.). *Gastroenterology* 69(1):154-159, 1975.

The effect of nicotine on the lower esophageal sphincter (LES) pressure in anesthetized opossums and the site of its action were studied. Opossums (*Didelphis virginiana*) were anesthetized, and intraluminal pressures were measured with a water-filled and continuously-perfused catheter system. Drugs were administered i.v.: nicotine sulfate (5-4000 µg/kg), atropine sulfate (30 µg/kg), propanolol (1 mg/kg), reserpine (3 mg/kg, twice) and hexamethonium. Nicotine sulfate caused a dose-dependent reduction in LES pressure. The threshold dose was less than 5 g/kg. The dose of 50 g/kg produced the maximal reduction in pressure (85%). Bilateral cervical vagotomy did not alter the effects of nicotine, nor did the adrenergic antagonist propanolol, or reserpine. Neither atropine nor hexamethonium (20 mg/kg) altered the effects of nicotine. LES response to 50 g/kg of nicotine during slow i.v. administration of 4 mg/kg of nicotine was markedly attenuated, indicating tachyphylaxis. The LES pressure during nicotine tachyphylaxis was 28.1 mm of Hg, and was reduced to only 23.9 mm of Hg with 50 g/kg of nicotine. The initial LES pressure fell 86.9% in five animals with a small dose of 0.2 g/kg of nicotine in the branch of the left gastric artery supplying the lower esophageal sphincter. There was a significant difference observed after electrical stimulation of the peripheral end of the vagus after bilateral cervical vagotomy between control (83.3%) and tachyphylaxis (31.8%). These data indicate a dose-dependent reduction in LES pressure following nicotine administration.

6684 FORCE VELOCITY CHARACTERISTICS OF OESOPHAGEAL MUSCLE: INTERACTION OF ISOPROTERENOL AND CALCIUM. *(E.)* Cohen, S. (Univ. Pennsylvania Hosp., 3400 Spruce St., Philadelphia, Pa. 19104). *Eur. J. Clin. Invest.* 5(3):259-265, 1975.

The interaction of isoproterenol and calcium on the force velocity characteristics of esophageal smooth muscle were evaluated. Smooth muscle strips were obtained from 20 adult opossums, and mounted to record tension generated by the circular layer. To obtain the force-velocity relation, the neurogenic response elicited at the termination of electrical stimulation was utilized. Force-velocity curves were constructed during superfusion of Kreb's solution containing 5.0 mM $Ca^{++}$ as well as the usual 2.5 mM $Ca^{++}$. After determination at the different calcium concentrations, isoproterenol ($10^{-7}$, $10^{-6}$, $10^{-5}$, and $10^{-4}$ M) was added to the superfusate. All muscle was studied at its length of optimal tension development (Lo). The maximal velocity of shortening ($V_{max}$) and the peak force (Po) of esophageal muscle were 6.2 mm/sec and 16.8 g, resp., at 2.5 mM calcium. Isoproterenol ($10^{-5}$ M) decreased the $V_{max}$ to 4.9 mm/sec and the Po to 9.8 g ($P < 0.01$). Increased calcium (5.0 mM) alone did not alter either $V_{max}$ or Po. At 5.0 mM calcium, $10^{-5}$ isoproterenol reduced the $V_{max}$ to 6.0 mm/sec and the Po to 13.9 g. These studies indicate that isoproterenol significantly reduces the $V_{max}$ and Po of esophageal smooth muscle during the neural mediated 'off response.' This effect of isoproterenol is reversed in part by an increase in calcium concentration.

6685 EFFECTS OF TEMPERATURE AND INORGANIC IONS ON CALCIUM ACCUMULATION IN MICROSOMES FROM INTESTINAL SMOOTH MUSCLE. *(Eng.)* Hurwitz, L.; Debbas, G.; Little, S. (Univ. New Mexico Sch. Medicine, Albuquerque, N. M.). *Mol. Cell. Biochem.* 8(1): 31-42, 1975.

The effects of alterations in temperature and in the inorganic ion composition of the bathing medium on the mechanical activity in intact muscle fibers and ATP-dependent calcium accumulation in microsomal vesicles were studied using the isolated longitudinal smooth muscle from guinea pig small intestine. The temperature was maintained at 10 or 30° C and the bathing medium contained $CdCl_2$, $BaCl_2$ and/or $MnCl_2$. Isotonic contractions of the longitudinal muscle were recorded following the addition of acetylcholine bromide ($1.4 \times 10^{-6}$ M) to the medium, and a microsomal fraction of muscle was assayed for calcium uptake and release and examined by electron microscopy. A reduction in temperature from 30 to 10 C inhibited the microsomal uptake and release of calcium. The change in temperature also slowed the rate of relaxation of the intact muscle after acetylcholine-induced contraction. The presence of $CdCl_2$ in the medium also decreased the uptake of calcium into the microsomal vesicles, but the release of calcium from the microsomes was accelerated. $BaCl_2$ had similar but less marked effects on calcium uptake and very little effect on calcium release. $MnCl_2$ had no significant effects on either uptake or release. Whereas both $CdCl_2$ and $MnCl_2$ exerted an inhibitory influence on the acetylcholine-induced contractile responses of the intact muscle fibers, $BaCl_2$ served to initiate a contractile response. Thus, the effects of temperature on microsomal calcium binding can be correlated with the effects on mechanical activity in the intact fibers, but the effects of $CdCl_2$, $BaCl_2$, and $MnCl_2$ on these two cellular processes do not show any consistent pattern.

6686 SUBSTITUTION OF $Ca^{++}$ WITH $Ba^{++}$ AND $Mn^{++}$ ON THE TONIC AND PHASIC CONTRACTIONS OF THE SMOOTH MUSCLE OF THE STOMACH. *(E.)* Boev, K.; Papazova, M.; Milousheva, E. (Bulgarian Acad. Sci.). *C. R. Acad. Bulg. Sci.* 28(4):553-556, 1975.

The effects of replacing $Ca^{++}$ in the bathing solution with $Ba^{++}$ or $Mn^{++}$ on the tonic and phasic contractions of the feline gastric smooth muscle was studied *in vitro*. Isolated strips of stomach were bathed in Krebs solution; in some experiments, sucrose (137 mN), $BaCl_2$ or $MnCl_2$ ($10^{-4}$ M), acetylocholine ($10^{-8}$, $10^{-7}$, or $10^{-6}$ M), $D_{609}$ ($10^{-5}$ M), nitroprusside sodium ($10^{-5}$ or $10^{-6}$ M), and/or EDTA ($5.10^{-4}$ M) were added to the solution. The sucrose gap method was used to study the electric and contractile activities of the muscle preparations. The phasic contractions of the antral muscle strips were completely inhibited by EDTA treatment and the removal of $Ca^{++}$ from the nutrient medium; the spontaneous myogenic tonus of the fundic strips was also abolished under these conditions. The addition of $BaCl_2$ to the $Ca^{++}$-deprived or EDTA-treated media led to a gradual restoration of the phasic activities in these strips. $D_{609}$, but not sodium nitroprusside, completely blocked the $Ba^{++}$-induced phasic contractions. The contractile activity in the strips bathed in medium containing EDTA but no $Ca^{++}$ disappeared prior to the appearance of characteristic changes in the bioelectric activity of the preparation. Acetylcholine activated the contractile activity of the preparations in the presence of $BaCl_2$, but had no such effect on medium containing neither $Ca^{++}$ nor $Ba^{++}$. In small doses, $Mn^{++}$ inhibited the tonic contractions of the fundic strips but had no influence on the phasic contractions of the antral strips. When added to a $Ca^{++}$-free medium containing EDTA, $Mn^{++}$ caused a gradual increase in the tonic contractions of the fundic and body strips; this effect was observed in the presence of $D_{600}$ but was blocked by sodium nitroprusside. The data indicate that the mechanisms of action of $Ba^{++}$ and $Mn^{++}$ on the smooth muscle cells of the stomach differ. They also emphasize the specificity which is characteristic of the different smooth muscles of the stomach.

6687 MODIFICATION BY EXTERNAL CALCIUM AND MAGNESIUM IONS OF THE POTENTIATIVE ACTION OF 5'-AMP ON THE ATP-INDUCED CONTRACTION OF ISOLATED GUINEA-PIG ILEUM. *(E.)* Iso, T. (Res. Lab., Santen Pharmaceutical Co., Ltd., Higashiyodogawa-ku, Osaka, Japan). *Jpn. J. Pharmacol.* 24(5):797-801, 1974.

Studies were undertaken to determine the effects of $Ca^{++}$ and $Mg^{++}$ concentrations in Tyrode solution on the contractile responses of isolated guinea-pig ileum to adenine nucleotides and acetycholine. ATP and ADP, but not AMP, produced contractions in the isolated ileum, with the contractile activity of ADP about three times as potent as that of ATP. Lowering the $Mg^{++}$ concentration below 1.0 mM (normal) enhanced the contractile responses to ATP and acetycholine, but lowering the $Ca^{++}$ concentration from 1.8 to 0.1 mM depressed the responses. This inhibitory effect of low $Ca^{++}$ on the contractile responses to low ATP concentrations ($3 \times 10^{-6}$ to $3 \times 10^{-5}$ M) was not observed in the absence of $Mg^{++}$; in contrast, the response to acetycholine was depressed by 0.1 mM $Ca^{++}$ in $Mg^{++}$-free medium. In normal Tyrode solution, the response to ATP was significantly potentiated by 5'-AMP (1 mM) but depressed by adenosine (1 mM). The contractile response to acetylcholine was slightly depressed by both 5'-AMP and adenosine. The potentiative action of 5'-AMP on the ATP-induced contraction in normal Tyrode solution disappeared at 0.1 mM $Ca^{++}$ in $Mg^{++}$-free medium. The inhibitory effects of 5'-AMP and adenosine on the acetylcholine-induced contraction were augmented by 0.1 mM $Ca^{++}$, as was the inhibitory effect of adenosine on the ATP-induced contraction. It is suggested that the depolarized state after low $Ca^{++}$ may play an important role in augmenting the inhibitory effect of 5'-AMP, although the mechanism of actions remains to be elucidated.

6688 THE EFFECT OF CHOLECYSTOKININ ON ELECTRICAL SPIKE POTENTIALS AND INTRALUMINAL PRESSURE VARIATIONS IN THE HUMAN SMALL INTESTINE. *(E.)* Oigaard, A.; Dorph, S.; Christensen, K. C.; Christiansen, L. (Rigshospitalet, Blegdamsvej 9, Copenhagen, DK-2100, Denmark). *Scand. J. Gastroenterol.* 10(3): 257-262, 1975.

The effect of cholecystokinin (CCK) on duodenal motility was studied in six patients with inguinal hernia and in nine patients with cholecystolithiasis. The effect of CCK on ileal motility was studied in six patients who had been treated with ileostomy for ulcerative colitis; of the cholecystolithiasis patients, five were studied before and after cholecystectomy, two were studied only preoperatively, and two were studied only postoperatively. Probes were passed into the distal part of the descending duodenum or about 10 cm into the ileum through the ileostomy. Recordings of the electrical spike potentials and intraluminal pressure were made before and after i.v. CCK (80 dog Ivy U, given over a 2-min period). In the duodenum, quantitative calculations of motility gave identical values before and after drug administration, and the results were identical in the cholecystolithiasis patients before and after surgery and in the hernia patients. A decrease in the amplitude of the spike potentials was observed in the duodenum during the first few min after drug administration in all groups. Recordings in the distal ileum showed a significant increase in motility after CCK, with no change in the spike potential amplitude. The data suggest that CCK has no effect on duodenal activity but that it does in some way modify the electrical activity of the smooth muscle cell.

6689 ELECTRICAL SPIKING ACTIVITY AND PROPULSION IN SMALL INTESTINE IN FED AND FASTED RATS. *(E.)* Ruckebusch, M.; Fioramonti, J. (Dept. Physiology, Natl. Veterinary Sch., 31076 Toulouse, France). *Gastroenterology* 68(6):1500-1508, 1975.

The role of food consumption on the pattern of the electrical spiking activities of the small intestine and on the time course of small intestinal propulsion were examined in male Wistar rats. From two to eight pairs of electrodes 2 mm apart were positioned at intervals of 10 cm; the first site was 10 cm from the pylorus. An indwelling polyethylene tube was placed in the duodenum or jejunum beneath an electrode site, and in the ileum, in 40 rats. Of these, 10 also had a gastric cannula. All rats were fed and received water *ad libitum* four days/week, and were fasted for 3 days/week. In both the fed and fasted rats, slow waves occurred at a high frequency in the duodenum (36-40/min) compared to the ileum (30/min). Almost continuous irregular spiking was recorded in fed rats, characterized by randomly occurring short spike bursts. The electrical spiking in fasted rats 6 hr after food withdrawal became regularly interspersed at 15-min intervals with periods of quiescence. The spiking activity showed two phases: 1) spike bursts on only 30% of the slow waves; and 2) all slow waves contained spike bursts of maximal duration. The corresponding integrated record for 24-hr fasted rats showed that the duration of the two phases occupied about 2/3 of the total recording time, and the migrating myoelectric complex as a whole occurred three to four times/hr. Intragastric administration of food and amino acids (NaCl, 3.6%, 10 ml; glucose, 8%, 5 ml; amino acids, 450 mM/l, 5 ml) caused continuous irregular spiking for 2 to 3 hr. A similar effect was caused by the food components administered into the duodenum. Oleic acid (0.1 ml) in either the stomach or duodenum caused continuous, but weak, irregular spiking. The velocity of intestinal transit was faster in fasted rats when phenol red (bolus) was administered before a migrating complex than after. The percentage of total bolus emptied by the stomach and each successive segment of the small intestine was approximately 30% and 65% in fed and fasted rats, resp. These data indicate that the presence of nutrients in the stomach and duodenum is capable of inducing a pattern of continuous irregular spiking activity.

6690 POTENTIATION BY COCAINE OF RELAXATIONS OF THE GUINEA-PIG COLON CAUSED BY NORADRENALINE AND BY STIMULATION OF ADRENERGIC NERVES. *(Eng.)* Costa, M.; Furness, J. B.; Dawson, K. (Dept. Zoology, Univ. Melbourne, Parkville, Victoria 3052, Australia). *Ajebak* 53(3):223-232, 1975.

The effects of cocaine on the noradrenaline-, isoprenaline-, and inhibitory nerve stimulation-induced relaxations in isolated segments of the guinea-pig distal colon were studied. Cocaine caused a three-fold sensitization of the muscle to noradrenaline but no sensitization to isoprenaline. Cocaine ($10^{-6}$ g/ml) also increased the duration, but not the amplitude, of the muscle relaxation observed when branches of the colonic nerves, which carry adrenergic fibers to the colon, were stimulated at frequencies of 1 to 32 Hz in the presence of hyoscine ($6\text{-}10^{-7}$ g/ml). In the presence of guanethidine, the response was not significantly prolonged by cocaine, but its amplitude was reduced slightly. Cocaine did not affect either the amplitudes or the durations of the responses to intrinsic nerve stimulation in the presence of hyoscine or guanethidine; the relaxation of the colon under intrinsic nerve stimulation has been shown to be due to the activation of nonadrenergic nerves. Fluorescence histochemical studies indicated that the adrenergic nerve terminals lie in Auerbach's plexus, not in the longitudinal muscle. It is concluded that the cocaine-induced sensitization to noradrenaline and the increases in the duration of response to adrenergic nerve stimulation are due to an inhibition of catecholamine uptake into the adrenergic nerves. It appears that even when the neuromuscular separation is large, as in the colon, the concentration of exogenous noradrenaline at the receptors can be decreased by neuronal uptake, and that the uptake mechanism can modify the responses in nerve stimulation *in vitro*.

6691 THE EFFECT OF GLUCOSE AND TETRAETHYLAMMONIUM ON THE PROPULSIVE MOTILITY OF SMALL INTESTINE IN HYPOPHYSECTOMIZED RATS. *(E.)* Peng, Y. I.; Peng, M. T. (Coll. Medicine, Natl. Taiwan Univ., Taipei). *J. Formosan Med. Assoc.* 73(8):445-450, 1974.

Blood sugar levels and the propulsive motility of the small intestine were measured simultaneously in tetraethylammonium chloride (TEA)-treated, insulin-hypoglycemic, and hypophysectomized rats to determine the mechanism of increased small intestinal motility after hypophysectomy. Male Long-Evans rats were

divided into groups receiving i.p.: 1) saline (1 ml/kg, control); 2) TEA (20 mg/kg); 3) insulin (2 U/kg); 4) insulin and TEA; 5) hypophysectomy with saline; 6) hypophysectomy with TEA; and 7) hypophysectomy with glucose (5%, 20 ml/kg, s.c.). Propulsive motility was determined by tracing the distance traversed by 10% charcoal (1 ml in 10% acasia by stomach tube). After insulin injection the blood sugar levels of the intact rats decreased to the levels of hypophysectomized rats and the motility of insulin-hypoglycemic rats increased to the level of the hypophysectomized rats. After glucose administration the blood sugar level of the hypophysectomized rats rose above normal levels and motility decreased to a value not significantly different from intact animals. Propulsive motility was significantly more rapid in hypophysectomized rats and insulin-hypoglycemic rats than in intact animals. TEA caused a significant decrease in motility in intact, hypophysectomized, and insulin-hypoglycemic rats compared with rats not receiving TEA. However, the motility of TEA-treated hypophysectomized and insulin-hypoglycemic rats was still significantly faster than that of TEA-treated intact rats. These results suggest that the low blood sugar levels of hypophysectomized rats induce increased small intestinal motility.

6692 ANALYSIS OF THE MOTOR EFFECTS OF 13-NORLEUCINE MOTILIN ON THE RABBIT, GUINEA PIG, RAT, AND HUMAN ALIMENTARY TRACT IN VITRO. *(E.)* Strunz, U.; Domschke, W.; Mitznegg, P.; Domschke, S.; Schubert, E.; Wunsch, E.; Jaeger, E.; Demling, L. (Dept. Medicine, Univ. Erlangen-Nuremberg, Krankenhausstrasse 12, D-852, Erlangen, West Germany). *Gastroenterology* 68(6):1485-1491, 1975.

Motor effects of 13-norleucine motilin (13-Nle-M), a synthetic polypeptide analog of motilin, on the contractility of the alimentary tract of rabbit, guinea pig, Wistar rat, and man were investigated *in vitro*. The effects of the drug were limited to specific regions of the gastrointestinal tract. Guinea pig and rat preparations were refractory to 13-Nle-M action. Stomach and upper small intestine muscle strips from the rabbit and man were highly sensitive to the drug; contractile responses were elicited with concentrations of $< 2 \times 10^{-9}$. Although circular muscle from rabbit colon responded to 13-Nle-M, *Taenia coli* preparations were unaffected by the polypeptide; in man the reverse occurred. Gallbladder, uterine, and vascular smooth muscle were unresponsive to 13-Nle-M. Pharmacological analysis revealed that 13-Nle-M acts directly on gastrointestinal smooth muscle and its effects are not mediated *via* nervous pathways. Ganglion blockade by hexamethonium iodide, blockade of axonal conduction by tetrodotoxin, or anticholinergic action by atropine failed to affect the polypeptide actions. It was concluded that 13-Nle-M caused contractions by stimulating receptors on or in muscle cells. Histamine receptors were differentiated from the site of action of 13-Nle-M by the use of the antihistamine pheniramine. The $Ca^{++}$ antagonist compound, verapamil, abolished the contractile response to 13-Nle-M. Thus, 13-Nle-M may be involved in the transport of $Ca^{++}$ to the cytosol of intestinal smooth muscle and cause the initiation of contraction.

6693 ANTIPHOSPHODIESTERASE ACTIVITY AND NON-SPECIFIC SMOOTH MUSCLE RELAXATION TESTED ON INTESTINAL SMOOTH MUSCLES. *(E.)* Inatomi, N.; Takayanagi, I.; Takagi, K. (Faculty Pharmaceutical Sciences, Univ. Tokyo, Bunkyo-Ku, Tokyo 113, Japan). *Jpn. J. Pharmacol.* 25(1):63-69, 1975.

The modes of action of papaverine and some nonspecific smooth muscle relaxants on phosphodiesterase were studied. Studies were also carried out to determine whether intestinal smooth muscle relaxation produced by the papaverine-like drugs is mediated by an increase in the intracellular cyclic AMP, which is caused by inhibition of phosphodiesterase. The circular muscle from dog small intestine and the guinea pig taenia coli were used. Extrapolation of double Lineweaver-Burk plots yielded two apparent Michaelis constants ($6.7 \times 10^{-6}$ M and $9.1 \times 10^{-5}$ M) for cAMP hydrolysis. Similar results were obtained in all enzyme preparations from guinea pig taenia coli and dog small intestine. Papaverine inhibited low $K_m$ enzyme completely. The synthetic antispasmodic drug 1,1-diphenyl-3-piperidinobutanol hydrochloride had little inhibitory action on either enzyme. Caffeine, sodium benzoate, and hydralazine in a 1000 x *g* supernatant of guinea pig taenia homogenate inhibited the low and high $K_m$ enzymes noncompetitively. Papaverine and aminophylline inhibited the low $K_m$ enzyme noncompetitively and the high $K_m$ competitively. The antiphosphodiesterase activities, as negative logarithms of $K_i$ values, of the median effective dose of papaverine almost equaled negative logarithm of its $K_i$ value. There was little correlation between the smooth muscle relaxing activities and the antiphosphodiesterase activities. It is concluded that there are at least two mechanisms for the nonspecific smooth muscle relaxants, one due to the increase of intracellular AMP caused by inhibition of phosphodiesterase, and the other not involved with the intracellular cAMP level.

6694 EFFECT OF PROSTAGLANDIN $E_1$ ON REACTIVITY OF RAT COLON, INCLUDING THE ROLE OF THE ADRENERGIC SYSTEM. *(Eng.)* Szalaj, W.; Gabryelewicz, A.; Stasiewicz, J. (Inst. Internal Medicine, Bialystok, Poland). *Mater. Med. Pol.* 7(2):99-101, 1975.

The effects of prostaglandin $E_1$ ($PGE_1$) on contractile activity and the functional state of adrenergic receptors of the proximal part of the colon in 26 male Wistar rats were studied by drug-induced stimulation and inhibition. $PGE_1$ administration (1, 10 and 100 µg/ml) caused colon contraction; the magnitude of contraction was dose-dependent. Administration of isoproterenol, a β-adrenergic agonist, 30 sec before $PGE_1$, produced a decrease in the contractile response (18%). Blocking β-adrenergic receptors with propranol augmented $PGE_1$-induced contraction (20%). Stimulation and inhibition of α-adrenergic receptors with L-phenylephrine hydrochloride and phentolamine, resp., produced insignificant changes in the response to $PGE_1$ (only a slight decrease in contraction). It is concluded that β-receptors have a stronger inhibiting influence than α-receptors and that the functional state of the adrenergic system, particularly the β-receptors, modifies the contractile response to $PGE_1$.

6695 EFFECT OF TWO METHYLATED PROSTAGLANDIN $E_2$ ANALOGUES ON GASTRODUODENAL PRESSURE IN MAN. *(E.)* Nylander, B.; Andersson, S. (Karolinska Hosp., Stockholm, Sweden). *Gut* 15(11):91-95, 1974.

The effects of two methylated analogues of prostaglandin $E_2$($PGE_2$), 16,16-dimethyl $PGE_2$ and 15(S)-15-methyl ester, on gastrointestinal motor activity was studied in five healthy men. The intraluminal pressure in the pyloric antrum and in the duodenum was recorded using small rubber balloons tied to a polyethylene tube; they were filled with water, and pressure was continuously recorded on a Rikadenki 3-channel recorder. Two types of experiments were performed. In the first, the subjects fasted overnight, and swallowed the balloon taped onto a Beckman glass electrode, the tip of which was positioned in the descending part of the duodenum *via* fluoroscopy. After a test meal (200 ml of meat bouillon), 80μg of 16,16-dimethyl $PGE_2$ was swallowed, followed by an identical test meal; subsequent pressure recordings revealed no significant changes in the motor response. However, p.o. administration of 140μg of the analogue completely inhibited motor activity in both the stomach and the duodenum. In an additional experiment, pressure recordings were made on two subjects during secretory tests after duodenal administration of 80 or 100μg of 15(S)-15-methyl $PGE_2$ methyl ester. Gastric secretion was continually stimulated by i.v. infusion of pentagastrin, and the gastric juice periodically collected. The balloon, located in mid duodenum, revealed almost complete inhibition of the duodenal motor activity in each instance. The lack of detectable effect of the 80μg dose of 16,16-dimethyl $PGE_2$ was noted, despite previous reports of the dose producing a marked inhibition (70%) of acid secretion. It is suggested that the $PGE_2$ analogue inhibited duodenal, as well as gastric, pressure by a similar direct effect on the smooth muscle, as had been recorded *in vitro*.

6696 EFFECT OF 16,16-DIMETHYL $PGE_2$ ON GASTRIC EMPTYING AND INTESTINAL TRANSIT OF A BARIUM-FOOD TEST MEAL IN MAN. *(E.)* Nylander, B.; Mattsson, O. (Karolinska Hosp. S-104 01, Stockholm 60, Sweden). *Scand. J. Gastroenterol.* 10(3):289-292, 1975.

The effect of 140 μg of 16,16-dimethyl prostaglandin $E_2$ (16,16-dimethyl $PGE_2$) on gastric emptying and intestinal transit of a barium-food mixture was studied in eight healthy adult males. Transport of the test meals from stomach to colon was followed by low dose fluoroscopy with repeated photographic recording (every 15 min during the first two hr after ingestion and then every half hr for an additional 1.5 hr). 16,16-Dimethyl $PGE_2$ significantly enhanced the rate of gastric emptying; the mean emptying times with and without this compound were 34 and 74 min, resp. In addition, food-contrast medium appeared sooner in the colon following 16,16-dimethyl $PGE_2$ administration. After administration of 16,16-dimethyl $PGE_2$ in five subjects, the duodenum and the first part of the jejunum appeared flaccid and dilated. It is postulated that the more rapid emptying of the stomach after administration of 16,16-dimethyl $PGE_2$ is due to a decreased duodenal resistance to the gastric outflow. Thus, the earlier appearance of contrast in the colon could be partially due to the more rapid gastric emptying following 16,16-dimethyl $PGE_2$ administration.

6697 INFLUENCE OF SULPIRIDE ON GASTROINTESTINAL MOTILITY. EXPERIMENTAL RADIOLOGICAL STUDY IN THE DOG. *(E.)* Boccadero, B.; Leonardi, L.; Calvari, A. R. (Inst. Veterinary Radiology, Univ. Milan, Italy). *Arzneim. Forsch.* 25(6):905-916, 1975.

The effect of N-ethyl-2(2-methoxy-5-sulfamido-benzamido-methyl)-pyrrolidine (sulpiride) on gastrointestinal motility during radiological examinations was studied in nine dogs. The drug was administered in a single dose either immediately after or 10 min before the barium meal. Sulpiride was given: i.v., 0.25 to 10 mg/kg; i.m., 1 to 4 mg/kg; p.o., 2.5 to 25 mg/kg (syrup); or p.o., 5 to 10 mg/kg (capsule). Over a period of 9 mo, 92 complete radiological examinations of the gastrointestinal tract were carried out. Generally sulpiride accelerated transit time and the optimal doses were: i.v., 1 mg/kg; i.m., 2 to 4 mg/kg; and syrup and capsule, 5 to 10 mg/kg. Strong, multiple peristaltic waves from the cardia towards the pylorus, consistent with the expression of gastric hyperkinesia, were seen in the stomach after sulpiride administration. A general increase of tonic activity and phasic activity, mainly of a propulsive type, was seen in the duodenum. Varying effects of the drug were seen in the jejunum and ileum which were independent of dosage or route of administration. These effects included: generalized hypertonia, generalized hypotonia and some periods of dystonia. The reaction in the colon was variable, including normal, segmentary or total hypertonia, or sometimes mild hypotonia. It is suggested that sulpiride be used in radiological examinations due to its effects on normal smooth gastrointestinal musculature.

6698 THE EFFECT OF DUODENAL INFUSION ON THE ELECTROMYOGRAM OF GASTRIC MUSCLE DURING ACTIVATION AND INHIBITION OF GASTRIC EMPTYING. *(E.)* Bell, F. R.; Grivel, M. (Royal Veterinary Coll., London, N.W. 1, England). *J. Physiol.* 248(2):377-391, 1975.

The effects of duodenal infusions of HCl and sodium bicarbonate on the activity of the gastric musculature were studied in conscious Friesian bull calves by recording the e.m.g. from antrum and fundus and simultaneously measuring the output of a test meal from the stomach. The test meals consisted of sodium bicarbonate, HCl, or distilled water with phenol red as a marker. E.m.g. recordings were made from the lesser and greater curvature of the fundus, from the antrum and pylorus of the abomasum, and from the duodenum; recordings were made before the onset of duodenal infusion, during duodenal infusion, and during simultaneous duodenal infusion and test meal administration. When the abomasum was partially distended by the water and bicarbonate, but not the HCl test meals, rhythmic motility was readily recorded from the e.m.g. of the smooth muscle of the fundus and antrum; the rhythmic contractions of the antrum during gastric evacuation of the meal were reinforced by both rhythmic and tonic fundic con-

tractions. The output volume of the stomach was directly correlated with the e.m.g. activity. The intragastric fluid was generally emptied in gushes coinciding with a strong contraction of the antrum; however, during periods of antral activity after ingestion of the HCl test meal, the fluid was evacuated *via* the force generated by persisting rhythmic fundic contractions. Using reentrant cannulas so that the duodenum could be infused separately from the gastric effluent, isotonic sodium bicarbonate produced almost 100% gastric evacuation with greatly enhanced e.m.g. activity of the fundus and antrum. Duodenal HCl produced the opposite effect, the gastric muscle becoming quiescent and 100% of the gastric test meal being retained. The data show that the activating or inhibitory effects of a duodenal infusate are produced through an activating or inhibitory effect on the smooth muscle of the stomach. The mechanism of the interrelationship between duodenal receptor and gastric effector is unclear, but the connection is not intramural since it continued when the duodenum was transected near the pylorus.

6699 EFFECT OF HEMORRHAGE ON MYOELECTRIC ACTIVITY OF STOMACH AND DUODENUM IN DOGS. *(E.)*
Kowalewski, K.; Zajac, S. (Surgical-Medical Res. Inst., Univ. Alberta, Edmonton, Alberta, Canada). *Surg. Gynecol. Obstet.* 141(2):227-231, 1975.

Systemic arterial hemorrhage was induced in male mongrel dogs, and the myoelectric activity of the stomach and duodenum during and after loss of blood was recorded. Dogs with previously implanted gastric and duodenal electrodes were used. A marked decrease in arterial blood pressure was observed in all dogs after each bleeding, although the effect was different in each dog. In all dogs, blood pressure fell to 0 mm of Hg after 75% blood loss. The average frequency of electrical control activity/min was 4.8 for the stomach and 18.9 for the duodenum, during the 30-min period preceding bleeding. Progressive loss of blood volume was accompanied by progressive deterioration of electrical recordings. The blood removed after four bleedings (60% total volume) was retransfused in 25 min. There was a simultaneous return of arterial blood pressure and electrical control activity to normal. Irregular bursts of spikes occurred in all stomachs after the third or fourth bleeding, which lasted for no more than 2 min and were associated with antral contractions. Hemorrhage induced major changes in some blood values, such as: pH, after bleeding 7.08 (before, 7.38); hemoglobin, 10.8 g% (11.9 g%); bicarbonate, 13.2 mEq/l (20.6 mEq/l); arterial $pO_2$, 53.1 mm Hg (82.0 mm Hg); venous $pO_2$, 26.0 mm Hg (34.0 mm Hg); arterial $pCO_2$, 24.0 mm Hg (33.4 mm Hg); and venous $pCO_2$, 55.1 mm Hg (30.6 mm Hg). These results confirm the importance of a time factor in the development of the metabolic effects of hemorrhage.

6700 EXPERIMENTAL ESOPHAGITIS IN CATS IMPAIRS LOWER ESOPHAGEAL SPHINCTER PRESSURE. *(E.)*
Eastwood, G. L.; Castell, D. O.; Higgs, R. H. (United States Naval Hosp., Philadelphia, Pa.). *Gastroenterology* 69(1):146-153, 1975.

The histological appearance of the lower esophagus was compared with lower esophageal sphincter (LES) pressure measurements, before and during the development of experimental esophagitis, as well as after a period of healing. All cats underwent baseline LES pressure measurements and mucosal suction biopsies. After 1 week, on each of 4 consecutive days, LES pressure was determined. A manometry tube was either then withdrawn or advanced 5 cm, and either the esophagus or stomach was perfused with 0.1 N HCl or distilled water, at the rate of 1.1 ml/min. On day 5, LES pressure was recorded and mucosal biopsies were taken. At the end of a 3.5-week recovery period, LES pressure and mucosal biopsies were again obtained. All initial biopsies were normal. Severe esophagitis developed in all five cats receiving 0.1 N HCl for 1 hr/day. Biopsy during the perfusion period in these animals showed an architecturally nondescript mass of inflammatory tissue devoid of surface epithelium. After the healing period, two of these five developed strictures; the surface epithelium had regenerated in the remaining three. After 4 days of esophageal perfusion for 0.5 hr/day, inflammatory changes were produced in all three cats in this group, although these changes were not so severe as those found in the first group. Mucosal edema and neutrophilic infiltration were also evident. All biopsies were normal after recovery. Controls receiving water or HCl in the stomach showed no mucosal abnormalities. There was no difference in mean LES pressure in the four groups before induction of esophagitis. LES pressure began to drop in the first group by perfusion day 2, and mean LES pressures on days 4 and 5 were significantly lower than basal values. A similar but less rapid fall occurred in LES pressures of cats in the second group. These results show that profound reductions in LES pressures are associated with the development of esophageal inflammation in cats, and that LES pressure returns to normal upon resolution of the inflammation.

6701 EFFECT OF ACUTE ISCHEMIA ON THE MOTILITY OF THE SMALL BOWEL IN THE AWAKE DOG. *(E.)*
Guisan, Y. J.; Hreno, A.; Gurd, F. N. (Montreal General Hosp., Montreal, Quebec, Canada). *Eur. Surg. Res.* 7(1):23-33, 1975.

A method was designed to allow the study of the small intestine motility response in intraluminal mucosal stimulation after ischemia in a 30-cm loop of the upper jejunum of mongrel dogs (26-28 kg). The effect of acute ischemia was obtained by clamping the feeding arteries. Studies were performed on the awake dog in order to eliminate anesthetic side-effect. A jejunostomy with a Roux-en-Y anastomosis for reestablishment of intestinal continuity was constructed to gain access to the upper jejunum. The jejunal segment proximal to the anastomosis was brought out through the skin. The motility was estimated after mucosal stimulation with a standard bolus of isotonic 0.1 N HCL (5 ml). Stimulation occurred every eight min and the time lag between stimulation and response, frequency, maximum and mean amplitude, and number of contractions were considered. This technique possessed high reproducibility; a typical response followed 42 of 45 bolus injections. Acute ischemia caused an immediate hyperexcitability of

the jejunum section under study, despite a complete destruction of the mucosa, followed by an irregular hyperexcitable pattern during the first 48 hr after injury. The controls presented a strongly diminished response to stimulation with a slow recovery. The hyperexcitable state which results after ischemia may mask more subtle changes in motility regulation which would be a consequence of specific mucosal damage.

6702 EFFECT OF A SEROTONIN ANTAGONIST (PCPA) ON THE DUMPING SYNDROME IN GASTRECTOMIZED DOGS. *(E.)* Bucholz, R. W.; Storer, E. H. (Veterans Admin. Hospital, West Haven, Conn.). *Surg. Forum* 24:414-416, 1973.

A recently discovered specific serotonin antagonist parachlorophenylalanine (PCPA) was used to study the role of serotonin release from the bowel in the gastrointestinal component of the dumping syndrome. Sixty percent gastric resections were performed on 10 dogs, and dumping was induced by instillation of a hypertonic glucose-barium meal through an orgastric tube. Criteria used to determine the presence of dumping included characteristic physical signs of dumping, fluoroscopic determination of bowel hypermotility, and serial roentgenograms. Dumping was easily induced in the gastrectomized dogs. However, s.c. administration of PCPA (75 mg/kg/day) for eight days successfully eliminated any signs of dumping after instillation of a hypertonic glucose-barium meal, and resulted in an average decrease in small-bowel serotonin to 10% of normal levels. Unlike previously studied antagonists, PCPA was a specific, potent inhibitor of serotonin synthesis, acting through inhibition of the rate-limiting enzyme tryptophan hydroxylase. Its role of an effective depletor of bowel serotonin, in the absence of side-effects on the metabolism of other biologic amines, is further evidence for a role of serotonin in the gastrointestinal component of the postgastrectomy dumping syndrome.

6703 THE EFFECT OF THE PYLORIC SPHINCTER ON STOMACH EMPTYING. *(Rus.)* Kharchenko, N. M.; Groisman, S. D. (Res. Inst. Physiol., Univ. Kiev, USSR). *Biull. Eksp. Biol. Med.* 79(2):26-29, 1975.

6704 THE INTERACTION OF $K^+$ AND ANGIOTENSIN IN THE ISOLATED DENERVATED RAT STOMACH. *(It.)* Cessi, C.; Bettini, V. (Inst. Fisiologia Umana, Univ. di Padova, Padua, Italy). *Boll. Soc. Ital. Biol. Sper.* 50(15):1231-1234, 1974.

6705 MOTOR ACTIVITY OF STOMACH AND INTESTINE WITH INJECTION OF SEROTONIN INTO HYPOTHALAMUS. *(Rus.)* Bogach, P. G.; Koval, L. A. (Inst. Physiology, State Univ., Kiev, USSR). *Fiziol. Zh. SSSR* 21(1):37-40, 1975.

6706 CONTRACTILE RESPONSES TO $Ca^{++}$ OF THE ISOLATED DENERVATED RAT STOMACH IN THE PRESENCE OF ANGIOTENSIN. *(It.)* Cessi, C.; Bettini, V. (Inst. Fisiologia Umana, Univ. Padova, Padua, Italy). *Boll. Soc. Ital. Biol. Sper.* 50(15):1225-1230, 1974.

6707 MODE OF ACTION OF BISACODYL (DULCOLAX) ON ISOLATED MUSCLES OF HUMAN COLON. *(Ger.)* Mitznegg, P.; Schubert, E.; Domschke, W.; Strunz, U.; Domschke, S.; Schwemmle, K.; Demling, L.; Heim, F. (Pharmakologisches Institut der Universitat Erlangen-Nurnberg, Erlangen-Nuremberg, Germany). *Klin. Wochenschr.* 53(10):493-495, 1975.

6708 THE IN VIVO EFFECTS OF PROSTAGLANDINS IN RAT JEJUNUM. *(E.)* Declusin, R.; Wall, M.; Whalen, G. (VA Hosp., Milwaukee, Wis.). *Gastroenterology* 68(4):1013, 1975.

6709 SMALL BOWEL MOTILITY DURING INTRAVENOUS HYPERALIMENTATION IN THE DOG. *(E.)* Weisbrodt, N. W.; Copeland, E. M.; Thor, P. J.; Dudrick, S. J. (Univ. Texas Med. Sch., Houston, Tex.). *Gastroenterology* 68(4):1011, 1975.

6710 EFFECT OF JEJUNAL PERFUSION OF AMINO ACIDS ON GALLBLADDER CONTRACTION IN DOGS. *(E.)* Gadacz, T. R.; Way, L. W. (Dep. Surg., Univ. California, San Francisco, Calif.). *Gastroenterology* 68(4):1009, 1975.

6711 DIFFERENTIAL GI SMOOTH MUSCLE EFFECTS BY INTRADUODENAL ADMINISTRATION OF SEVERAL FATTY ACIDS. *(E.)* Stewart, J. J.; Bass, P. (Univ. Wisconsin Cent. Health Sci., Madison, Wis.). *Gastroenterology* 68(4):991, 1975.

6712 INFLUENCE OF GASTROINTESTINAL HORMONE STIMULATION AND LUMINAL VOLUME ON GALLBLADDER FUNCTION. *(E.)* Ryan, J.; Cohen, S. (Hosp. Univ. Pennsylvania, Philadelphia, Pa.). *Gastroenterology* 68(4):977, 1975.

6713 ENHANCING ACCOMODATION OF THE CANINE GASTRIC FUNDUS WITH PENTAGASTRIN. *(E.)* Okike, N.; Kelly, K. A. (Mayo Clin., Rochester, Minn.). *Gastroenterology* 68(4):964, 1975.

6714 THE EFFECT OF GASTRIN, CHOLECYSTOKININ-PANCREOSIMIN [SIC!], AND SECRETIN ON THE INTERACTION OF THE MOTOR FUNCTION OF THE STOMACH, DUODENUM AND BILIARY TRACT. *(Rus.)* Barashkova, G. M. (I. P. Pavlov Inst. Physiology, Leningrad, USSR). *Fiziol. Zh. SSSR* 61(5):763-773, 1975.

6715 ACTION MECHANISM OF BISACODYL ON THE SMOOTH MUSCULATURE OF THE SMALL AND LARGE INTESTINE IN GUINEA PIGS. *(Ger.)* Schubert, E.; Strunz, U.; Mitznegg, P.; Domschke, S.; Domschke, W.; Demling, L. (Pharmacological Inst., Univ. Erlangen, Erlangen, Germany). *Arzneim. Forsch.* 25(7):1053-1056, 1975.

6716 MODE OF ACTION OF SPASMOGENS (K, ACETYLCHOLINE, Ba) AND RELAXANTS (ISOPROTERENOL, Mn, PAPAVERINE) ON THE EXCISED JEJUNUM OF THE MOUSE, PARTICULARLY IN RELATION TO Ca. *(Jpn.)* Kaniyashiki, E. (Kobe Univ. Sch. Medicine, Ikuta-ku, Kobe 650, Japan). *Folia Pharmacol. Jpn.* 70(5):589-601, 1974.

6717 ON PARTICIPATION OF THE CAT COLON'S INTRAMURAL SYSTEM IN ORGANIZATION OF ITS RHYTHMIC CONTRACTILITY IN SITU. *(Rus.)* Pakhomov, A. I.; Stepanov, I. I.; Bukreeva, N. N.; Khoptiar, V. P. (1st Leningrad Medical Inst. USSR, Leningrad, USSR). *Fiziol. Zh. SSSR* 61(5):731-737, 1975.

6718 GASTRIC EMPTYING AND INTESTINAL TRANSIT AFTER DISULFIRAM TREATMENT IN RAT. *(Fr.)* Lambeouf, Y.; Fritsch, P.; De Saint-Blanquat, G. (INSERM U-87, F 31400 Toulouse, France). *Biol. Gastroenterol. (Paris)* 8(1):39-44, 1975.

6719 MODIFICATIONS OF THE ELECTRIC ACTIVITY OF THE PROXIMAL COLON IN THE RABBIT IN VIVO BY STIMULATION OF THE VAGAL AND SPLANCHNIC NERVES. *(Fr.)* Jule, Y. (C.N.R.S., INP 1, 31 chemin Joseph Aiguier, 13274 Marseille Cedex 2, France). *J. Physiol. (Paris)* 70(1):5-26, 1975.

6720 TWO TYPES OF GASTRIC MOTOR RESPONSE TO ATROPINE ADMINISTERED INTRAVENOUSLY. *(Cz.)* Enderle, E.; Pallova, S. (Inst. Postgraduate Medicine Pharmacy, Praha 4, Budejovica 800, Czechoslovakia). *Cesk. Gastroenterol. Vyz.* 28(8):545-550, 1974.

6721 INFLUENCE OF AUTOGENOUS RELAXATION ON OESOPHAGEAL MOTILITY. *(Ger.)* Berner, P.; Fink, G.; Naske, R.; Stacher, G. (Psychiatrischen Universitatsklinik Wien, Vienna, Austria). *Z. Psychosom. Med. Psychoanal.* 20(4):384-390, 1974.

6722 BIOPOTENTIALS OF THE STOMACH SMOOTH MUSCLES AND ITS MOTILITY. *(Rus.)* Ustinov, V. N. (Pavlov's Inst. Physiology, Leningrad, USSR). *Fiziol. Zh. SSSR im. I.M. Sechenova* 61(4):620-627, 1975.

See also, 6600, 6762, 7074, 7160, 7485.

## SECRETION AND METABOLISM

6723 EFFECT OF CROMOLYN SODIUM AND DEUTERIUM OXIDE ON ANAPHYLACTIC HISTAMINE RELEASE FROM RAT PERITONEAL MAST CELLS IN VITRO. *(Eng.)* Herzig, D. J.; Kusner, E. J. (Warner-Lambert Res. Inst., Morris Plains, N. J. 07950). *J. Pharmacol. Exp. Ther.* 194(2):457-462, 1975.

The effect of deuterium oxide and cromolyn sodium on anaphylactic histamine release from rat peritoneal mast cells was studied *in vitro*. Mast cells from 6-wk-old male Sprague-Dawley rats were sensitized *in vitro* with rat reaginic antiovalbumin and challenged with ovalbumin, $D_2O$, and/or cromolyn sodium. After 5 min, the cells were removed from the medium, which was assayed for histamine using fluorometric techniques. At 37 C, $D_2O$ caused a concentration-dependent potentiation of anaphylactic histamine release from the mast cells; there was a 1.3-fold potentiation with 5% (v/v) $D_2O$ and a three-fold potentiation at 25% $D_2O$ (v/v). At these concentrations, $D_2O$ had no effect on spontaneous histamine release. The high rate of histamine release in 25% $D_2O$ was not attributed to mast cell destruction, as trypan blue was actively excluded by the cells under these conditions. When the sensitized cells were challenged with antigen at 25 C in the presence and absence of $D_2O$, the $D_2O$ proportionately increased both the rate of histamine release and the total amount of histamine released, so that half-time of release was not affected by $D_2O$. The concentration of cromolyn sodium required to obtain 50% inhibition of histamine release increased from 6 μM without $D_2O$ to 80 μM in 10% $D_2O$ and to greater than 500 μM in 25% $D_2O$. However, the graph showing the relationship between cromolyn sodium concentration and percent histamine release was not shifted in a parallel manner by $D_2O$. This suggests that the interaction between $D_2O$, cromolyn sodium, and the histamine-releasing processes of mast cells is not a simple one.

6724 STUDIES ON THE CALCEMIC EFFECT OF INTRAVENOUS SECRETIN IN HUMANS. *(E.)* Schwille, P. O.; Scholz, D.; Samberger, N. M.; Kayser, P. E. (Mineral Metabolism Lab., Univ. Erlangen-Nürnberg, Erlangen, West Germany). *Acta Hepato-Gastroenterol.* 22(3):195-200, 1975.

To elucidate the nature of observed hypercalcemia after secretin administration, patients with duodenal ulcer (Group 1), primary hyperparathyroidism (Group 2), one case of excluded antrum, and normal subjects were evaluated after infusion of pure, natural secretin (3 U/kg/hr), after a 12-hr fast. The average control increment in total Ca was 0.45 mg/100 ml after 45 min of infusion; Groups 1 and 2 had increments of 0.75 mg/100 ml after 90 min of infusion. A highly significant correlation was found between protein-bound Ca and total protein in Group 1 only. Inorganic plasma P dropped slightly in Group 2 and in controls, but remained stable in Group 1. Baseline-ionized Ca values remained stable in all groups. A slight but significant mean fall in gastrin was seen in controls and in Group 1.

Group 2 had a slight rise in gastrin, but this could be due to a variance in the assay procedure. The integrated gastrin response revealed no difference between the groups. All subjects had a small rise in glucagon; values for Group 2 were significantly higher than controls. Integrated glucagon showed that α cells in Group 2 maintained a high hormone output. Urinary excretion of P, Ca, and Na were normal in controls and in Group 1, and higher in Group 2 (as expected). Together with the data from the patient with excluded antrum, it is concluded that the hypercalcemic effect of secretin is not mediated by Ca regulatory hormones, but must be of an unspecific nature.

6725 THE EFFECT OF SUBDIAPHRAGMATIC VAGOTOMY ON METABOLISM OF IRON IN RATS. *(Rus.)* Eletskii, Iu. K.; Tsibulevskii, A. Iu.; Bolshakova, G. A. (N. I. Pirogov 2nd Moscow Medical Inst., Moscow, USSR). *Dokl. Akad. Nauk SSSR* 222(5):1252-1253, 1975.

6726 INHIBITION OF HEPATIC DRUG-METABOLIZING ENZYMES BY THIOPHOSPHATE INSECTICIDES AND ITS DRUG TOXICOLOGICAL IMPLICATIONS. *(E.)* Uchiyzmz, M.; Yoshida, T.; Homma, K.; Hongo, T. (Pharmaceutical Inst., Tohoku Univ., Sendai, Japan). *Biochem. Pharmacol.* 24(11-12):1221-1225, 1975.

6727 REGULATION OF PROTEIN SECRETION AND METABOLISM IN RAT SALIVARY GLANDS. EFFECTS OF NOREPINEPHRINE AND CARBACHOL ON THE GLYCOGENOLYSIS IN SUBMAXILLARY GLANDS. *(E.)* Herman, G.; Rossignol, B. (Inst. Biochimie, Univ. Paris-Sud, Orsay, France). *Eur. J. Biochem.* 55(1):105-110, 1975.

See also, 6634, 6905, 7036.

## SECRETION AND METABOLISM

### Stomach

6728 ARE NON-ABSORBABLE INDICATORS OF COMPARABLE VALUE IN THE HUMAN STOMACH MADE ABNORMAL BY TAUROCHOLIC ACID? *(E.)* Ivey, K. J.; Parsons, C. (R. Prince Alfred Hosp., Sydney, Australia). *Clin. Exp. Pharmacol. Physiol.* 2(2):151-157, 1975.

Chromium-51 ($^{51}CrCl_3$) and phenolsulfonphthalein (phenol red) were compared as nonabsorbable indicators of gastric secretion and emptying in the human stomach before and after alteration of the ionic permeability of the gastric mucosa by taurocholate. Nasogastric tubes were positioned in the fasting stomachs of healthy male volunteers and a 200 ml portion of test solution containing 160 mM HCl, phenol red, $^{51}CrCl_3$, and polyethylene glycol (PEG) was introduced; in some tests, the test solution also contained 10 mM taurocholic acid. The indicators were measured in the original test solution and in gastric aspirates obtained immediately after ingestion of the test solution and at intervals 15 and 30 min later. The ratios of the initial and final concentrations of the indicators ($C_i:C_f$) were compared. Correlation coefficients of the $C_i:C_f$ ratios for $^{51}CrCl_3$ and phenol red were 0.91 in the control studies and 0.75 after taurocholic acid instillation; there was no significant difference with either indicator. During taurocholic acid instillation, the $C_i:C_f$ values tended to fall in comparison with the control values. In a smaller number of subjects in whom PEG was also measured, the results were similar to those obtained with $^{51}CrCl_3$ and phenol red. The results therefore indicate that $^{51}CrCl_3$, phenol red, and PEG are comparable indicators in the normal human stomach and in the stomach made abnormal by a lipid-soluble agent such as unionized tarurcholic acid, although the correlation between indicators is reduced in the abnormal stomach. No evidence of increased absorption of any indicator was found in spite of the increased ionic permeability produced by taurocholic acid.

6729 RADIOAUTOGRAPHIC AND QUANTITATIVE STUDIES ON PARIETAL AND PEPTIC CELL KINETICS IN THE MOUSE. *(E.)* Willems, G.; Lehy, T. (Hopital Bichat, Paris, France). *Gastroenterology* 69(2):416-426, 1975.

Radioautography after *in vivo* labeling with ($^3H$)thymidine (1 μc/gm, i.p. on the third, fourth, and fifth days) was used to estimate DNA synthesis in progenitor cells and parietal and peptic cell proliferation during the chronic administration of natural gastrin (10 μg in 0.2 ml saline s.c. every 8 hr for 20 days) to male Swiss albino mice. The stomachs were examined 0-14 days after the last ($^3H$)-thymidine injection. The gastrin-treated mice did not differ from a group of saline-treated controls in terms of body weight gain, and no macroscopic or microscopic ulcers were seen in the gastric mucosa at the time of death. At 0 days after the termination of ($^3H$)thymidine treatment, few labeled parietal cells were seen in either the gastrin-treated or control mice; most labeled cells were undifferentiated or mucous cells. Thereafter, the population of labeled parietal cells increased significantly, reaching a peak level (254.15 labeled cells/5000 parietal cells) on the fifth day after termination of ($^3H$)thymidine treatment in the controls and on the third day in the gastrin-treated animals. In comparison with the controls, there was a 1.27% excess

production of new parietal cells/day in the gastrin-treated animals, and after 20 days of gastrin treatment there was a 20% excess in total parietal cells. More than 95% of the new cells in both groups originated in the "superficial parietal cell area." The controls and gastrin-treated mice did not differ in terms of the proliferative activity of the peptic cells; the ratio of peptic cells to parietal cells was significantly reduced in the gastrin-treated mice at the termination of gastrin treatment. The data indicate that more than 95% of the parietal cells originate from the differentiation of immature progenitor cells in the neck area of the glands and that most peptic cells are renewed through cell replication of other peptic cells. Gastrin augments the production of parietal cells *via* acceleration of the maturation process of progenitor cells into parietal cells, increased duplication of progenitor cells, and augmentation of the proportion of stem cells being transformed into parietal cells.

6730 EFFECT OF PROLONGED ADMINISTRATION OF HOMOLOGOUS AND HETEROLOGOUS INTRINSIC FACTOR ANTIBODIES ON THE PARIETAL AND PEPTIC CELL MASSES AND THE SECRETORY FUNCTION OF THE RAT GASTRIC MUCOSA. *(E.)* Inada, M.; Glass, G. B. J. (New York Medical Coll., New York, N.Y. 10029). *Gastroenterology* 69(2):396-408, 1975.

To determine the effects of circulating intrinsic factor antibodies (IFA) on gastric morphology and secretory function, female Sprague-Dawley rats were given daily i.v. injections of immunoglobulin G (IgG, 4 mg in 0.5 ml of normal saline). The IgG fractions were separated on DEAE cellulose columns from sera of patients with pernicious anemia, containing both IFA and parietal cell antibodies (PCA); sera from patients with atrophic gastritis, containing PCA only; or sera from rabbits immunized with semipurified human or rat IF. Control rats were treated with saline or IgG processed from normal human or rabbit sera, or were untreated. One-third of each group was intubated biweekly after fasting and histamine stimulation (0.1 mg/kg, s.c.) and the hourly output of HCl, pepsin, and IF were determined. At the end of the experiment, the rats were killed and the mucosal surface and thickness were measured; the parietal cell and peptic cell masses were counted at the same time. In the control groups, there was either no change or a progressive growth in the cellular mass of the gastric mucosa; the latter was accompanied by no change or an increase in the HCl, pepsin, and IF outputs. In contrast, the rats injected with IgG containing IFA to human or rat IF showed a statistically significant thinning of the gastric mucosa, a reduction in peptic cell number, and corresponding decreases in the output of pepsin and IF. The latter were reduced 50% from the initial values and 62 and 75%, resp., when compared with the normal human and rat IgG-injected controls. In animals injected with the IgG fractions from the pernicious anemia sera, the output of IF, pepsin, and HCl was significantly decreased, as were the peptic and parietal cell masses. Thinning of the gastric mucosa, a reduction in the parietal cell mass, and a significant decrease in the HCl output were observed in the rats injected with the atrophic gastritis IgG; the outputs of pepsin and IF were also significantly reduced in these animals. The data suggest the participation of humoral immunological mechanisms in the production of gastric atrophy and secretory failure.

6731 UNIQUE ENZYMES OF PURIFIED MICROSOMES FROM PIG FUNDIC MUCOSA: $K^+$-STIMULATED ADENOSINE TRIPHOSPHATASE AND $K^+$-STIMULATED pNPPase. *(E.)* Forte, J. G.; Ganser, A.; Beesley, R.; Forte, T. M. (Dept. Physiology-Anatomy, Univ. California, Berkeley, Calif. 94720). *Gastroenterology* 69(1):175-189, 1975.

The microsomal fraction from pig fundic gastric mucosa was assayed for the presence of $K^+$-stimulated ATPase and $K^+$-phosphatase activities. The microsomal fraction was isolated by differential centrifugation and density gradient fractionation. In addition to the enzyme assays, determinations of the microsomal protein content and RNA were made, and the membrane fractions were studied by electron microscopy. The microsomal fractions showed high levels of $K^+$-stimulated ATPase and $K^+$-stimulated phosphatase activity, while similar preparations from antral mucosa showed virtually no such activity. A low density band of membranes from the fundic preparations (peak 1.12-1.13 g/ml) possessed all of the $K^+$-stimulated enzyme activities. The morphological features and abundant glycoproteins of this fraction suggested that the low density microsomes might be derived from the tubulovesicles of oxyntic cells. Mitochondrial and ribosomal markers were associated with membranes with much higher densities (greater than 1.22 g/ml). The $K^+$-stimulated ATPase showed a pH optimum of 7.5 and required $Mg^{++}$, but neither $Na^+$ nor ouabain had any appreciable effect on the activity. $K^+$ stimulation of basal ATPase ranged from 1.5 to 3.0-fold with an apparent $K_a$ for activation between 0.2 and 0.4 mM of $K^+$. The addition of various $K^+$ ionophoretic substances such as gramicidin resulted in up to 6-fold stimulation of the basal $K^+$-ATPase activity. The mean activities of seven separate preparations of purified low density pig fundic microsomes were (μM of ATP hydrolyzed/mg of protein/hr): basal ATPase, 15.8; basal ATPase plus 10 mM of $K^+$, 29.3; plus 10 mM of $K^+$ and $10^{-5}$ M of gramicidin, 45.2. Neither the basal ATPase nor the $K^+$-stimulated activities were altered by $HCO_3^-$ or $Cl^-$. The occurrence of these unique enzyme activities in the oxyntic region of the gastric mucosa suggests some relation with secretory activity, but further research is needed to elaborate the physiological function of this gastric system.

6732 MECHANISMS FOR CATECHOLAMINE DISENCAGEMENT FROM VARIOUS PARTS OF THE STOMACH AND THEIR ACCUMULATION IN GASTRIC TISSUE. *(Rus.)* Mirzoian, S. A.; Virabian, T. L. (Erevan Med. Inst., USSR). *Zh. Eksp. Klin. Med.* 14(2):3-8, 1974.

The content of adrenalin and noradrenalin was compared in the blood flowing from the lesser and greater curvatures of the stomachs of dogs and in the walls of the isolated stomachs of rats under the influence of various doses of quateron and acetylcholine. The motor function of the lesser and greater curvatures of the stomach was recorded by an electrogastrograph with a set of platinum electrodes.

The content of adrenalin and noradrenalin was determined spectrofluorometrically. Results showed that i.v. introduction of acetylcholine (5 μg/kg), small doses of quateron (0.2 mg/kg), and irritation of the vagus nerve (by faradization) together with the enhancement of motor function of the stomach increased the catecholamine content in the blood, in the stomach, and in the tissues of the stomach walls. Larger doses of quateron (2 mg/kg) promoted the accumulation of catecholamines in tissues of the stomach walls, but inhibited the motor activity of the stomach and reduced the contents of adrenalin as well as of noradrenalin in the blood and in the stomach. This double effect of high doses of quateron is attributed to quateron's cholino-positive influence as a result of which the larger doses of quateron promote accumulation of catecholamines in tissues of stomach walls, simultaneously suppressing their disengagement from the stomach tissue.

6733 METABOLISM OF SYNTHETIC HUMAN GASTRIN AND DNS-GASTRIN IN RATS AND MICE. *(E.)* Matsuyama, T.; Kodama, M.; Nagao, Y. (Hiroshima Univ. Sch. Medicine, Japan). *Hiroshima J. Med. Sci.* 23(2/3):155-164, 1974.

The metabolism of synthetic human gastrin (SHG) and DNS-gastrin was studied in DDY mice and Wistar rats. $^{3}$H-SHG (15 mg/kg) was injected into the tail veins of conscious mice and the animals were frozen 10 or 30 min later. The mice were then sectioned and examined by whole body autoradiogram. The experiment was repeated following the i.v. administration of $^{14}$C-DNS-gastrin (1.3 mg/kg). In the second experiment, $^{3}$H-SHG (200 μg/kg) was injected i.v. into normal rats and animals which had undergone bilateral nephrectomy; $^{14}$C-DNS-gastrin was similarly injected into normal rats and animals which had undergone bile duct ligation. Blood was withdrawn 1 to 360 min after injection and its radioactivity determined. In a third experiment, $^{3}$H-SHG (2.5 μg/kg) was injected i.v. into Wistar rats and the bile and urine were collected at 10 min intervals and respective radioactivities were determined. In the first experiment, strong radioactivity was seen in the renal cortex, renal pelvis, bladder contents, bladder mucosa, and gallbladder 10 min after $^{3}$H-SHG injection. After 30 min, the concentration of label in the bladder contents and gallbladder had increased, but the activity in the renal cortex and liver was still strong. Ten min after $^{14}$C-DNS-gastrin administration, there was a large amount of radiation in the liver, and after 30 min the gallbladder was markedly distended with strongly radioactive bile; there were also marked accumulations of activity in the kidney and bladder contents. In the second experiment, radioactivity tended to be retained in the blood longer in the nephrectomized rats than in the normal rats. The retention of radioactivity in the blood of the bile duct-ligated group was also markedly prolonged. In the third experiment, 44.9% of the total radioactivity was eliminated from the body within 3 hr; 33% was excreted in the urine and 11.9% was excreted in the bile. The data indicate that SHG is metabolized in the urinary system, mainly in the renal cortex, and that DNS-gastrin is primarily metabolized in the liver and bile duct.

6734 SYNTHESIS AND SECRETION OF PROTEIN AND PEPSINOGEN BY RABBIT GASTRIC MUCOSA IN ORGAN CULTURE. *(E.)* Sutton, D. R.; Donaldson, R. M., Jr. (Boston Univ. Sch. Medicine, Mass.). *Gastroenterology* 69(1):166-174, 1975.

The active synthesis and secretion of proteins, including pepsinogen, by gastric mucosal biopsies *in vitro* are reported. Mucosal biopsies were obtained from the stomachs of white New Zealand rabbits. To assess incorporation of amino acid into tissue protein, L-[1-$^{14}$C]leucine (2 μCi) was added to each ml of culture medium. Secretion of labeled proteins was studied by centrifugation and dialyzation, or in pulse-chase experiments with 5 μCi/ml of [$^{14}$C]leucine. Incorporation of radioactivity into tissue protein was linear with time up to 24 hr in continuous cultures; secretion was also linear after an initial lag of 3 to 6 hr. Biopsies cultured in an isotope-free medium and then transferred to a labeled medium showed the same rate of incorporation as in freshly-excised biopsies. Incorporation of radioactivity was inhibited 96% by cycloheximide at 0.5 mg/ml for 1 hr, and by 99% for 24 hr. Total pepsin activity in cultured biopsies did not decrease, but a linear increase was seen in the culture medium, at 24 hr corresponding to 40% of that originally present in the biopsies. Gel electrophoresis showed a single major peak of radioactivity approximating the position of a stained band of protein obtained during electrophoresis of hog pepsin. This also corresponded to the peak obtained by gel filtration. Ion exchange chromatography showed four peaks, each of which coincided with pepsin activity. Acetylcholine markedly stimulated secretion of labeled protein and pepsinogen. Acetylcholine, pentagastrin, secretin, and the octapeptide of cholecystokinin (in $10^{-10}$ M concentrations) stimulated protein secretion. Overall incorporation of radioactivity was stimulated by $10^{-9}$ M pentagastrin. These data indicate a direct *in vitro* effect of pentagastrin on protein synthesis, and suggest the *de novo* synthesis of pepsinogen by isolated gastric mucosa.

6735 IN VITRO INCORPORATION OF $^{35}SO_4$ INTO RAT GASTRIC POLYANIONS AND THEIR DEGRADATION BY GASTRIC ENZYMES. *(E.)* Liau, Y. H.; Horowitz, M. I. (New York Medical Coll., Valhalla, N.Y. 10595). *Digestion* 11(5-6):370-381, 1974.

The *in vitro* incorporation of $^{35}$S-sulfate into gastric polyanions was studied using whole stomach (mucosa and muscle) and cartilage from a male Sprague-Dawley rat. Pieces of this tissue were incubated for 16 hr in Joklik-modified minimum essential medium containing 100 μCi $Na_2{}^{35}SO_4$. The gastric polyanions from the stomach tissue, incubation medium, and rib-cartilage were subsequently fractionated and the fractions analyzed by thin-layer chromatography, cellulose acetate electrophoresis, paper electrophoresis, and scintillation counting. The sulfatase activity of crude gastric enzyme toward each fraction was also determined. $^{35}$S-sulfate was incorporated into the acidic mucopolysaccharides, various glycoprotein fractions, and sulfatides of the tissue and medium. More radioactive sulfate was incorpor-

ated into the soluble and medium components than into the tissue-bound components, and the distribution of $^{35}S$ in stomach fractions was quite different from that in rib fractions. Detergent fractionation and electrophoresis suggested the presence of sulfated polyanions not previously described for this tissue. In the studies with crude gastric enzyme, inorganic sulfate was liberated only from the fractions containing chondroitin sulfates. The gastric enzyme also liberated organic sulfates from chondroitin sulfates and from sulfated glycoproteins. The results suggest that sulfation in the stomach tissue occurred in a wide variety of polyanions besides the chondroitin sulfates, that partial desulfation of the chondroitin sulfates had occurred before isolation from the tissue, that a significant mucolytic action may occur in stomach tissue, and that the majority of $^{35}S$-labeled substances were probably composed of glycoproteins.

6736 VITAMIN $B_{12}$-BINDING PROTEINS IN HUMAN GASTRIC MUCOSA: GENERAL PATTERN AND DEMONSTRATION OF INTRINSIC FACTOR ISOPROTEINS TYPICAL OF MUCOSA. *(E.)* Marcoullis, G.; Gräsbeck, R. (Minerva Foundation Inst. Medical Res., P. O. Box 819, SF-00101, Helsinki 10, Finland). *Scand. J. Clin. Lab. Invest.* 35(1):5-11, 1975.

The nature of intrinsic factor in human gastric mucosa was studied. Submucosal and mucosal homogenates were prepared from stomach specimens taken at surgery. Only macroscopically normal-appearing tissue was used. Samples were analyzed by gel filtration, cellulose column chromatography and isoelectric focusing. For logical indentification of vitamin $B_{12}$-binding proteins, a serum from a patient with pernicious anemia with antibodies binding the $B_{12}$-intrinsic factor complex and a rabbit antiserum against a crude preparation of a $B_{12}$-binding protein were used. Sedimentation coefficients were also estimated. After gel filtration of 2 to 3 ml samples of mucosal extracts, radioactive peaks were identified as the $B_{12}$ complexes of R protein and intrinsic factor. The $B_{12}$-intrinsic factor peak disappeared after addition of pernicious anemia and rabbit antisera. A small quantity of transcobalamin II was also detected. The molecular weight of the mucosal complex was shown to be about 1,400 daltons less than that of the gastric juice complex. Isoelectric focusing showed that mucosal extract contained components with pI's that were closer to neutral than to those of gastric juice. The presence of these neutral components (N-components) was also demonstrated by column chromatography. After isoelectric focusing, one N-component resolved into components isoelectric at pH 5.95, 6.25 and 6.52. Simultaneous centrifugation of mucosal and gastric juice $B_{12}$-intrinsic factor complexes showed no difference in sedimentation rate. When they were centrifuged together with leukoagglutinin, a sedimentation coefficient of 4.1S was obtained for the $B_{12}$-intrinsic factor complex. It is suggested that the intrinsic factor isoprotein phenomenon in gastric juice and mucosa is best explained by a similar polypeptide chain binding carbohydrate chains, which vary in sialic acid composition and also with respect to other carbohydrates.

6737 A HISTOCHEMICAL APPROACH TO THE CHOLINERGIC INNERVATION OF ENDOCRINE-LIKE CELLS IN DOG ANTRO-PYLORIC MUCOSA. *(E.)* Yamaguchi, I.; Mori, J.; Honda, F.; Nishizaki, H.; Kumada, S. (Fujisawa Pharmaceutical Co. Ltd., Yodogawa-Ku, Osaka, Japan). *Jpn. J. Pharmacol.* 24(5):721-728, 1974.

The cholinergic innervation of endocrine-like cells was studied in such a way so that the cells and the acetyl cholinesterase activity were demonstrated by formaldehyde-HCl treatment and the acetylthiocholine method, resp. The cholinergic innervation of endocrine-like cells in the antropyloric areas was compared with that of exocrine cells in the fundic gland. Tissue sections were taken from the stomachs of anesthetized mongrel dogs. Sections were fixed, stained and examined by fluorescence and light microscopy. Acetyl cholinesterase staining showed cholinergic nerve fibers with a wide distribution in the fundic mucosa, especially in the middle area. Nerve fibers were also seen in close proximity to the base of secretory cells, a few in the superficial 1/5 of the mucosa and large bundles emanated from the submucosa. In comparison, chief cells were arranged in a single layer around the gastric lumen, and were distributed in the lower 2/3 of the mucosa. The arrangement of parietal cells was similar. Most cholinergic nerve fibers were distributed in the basal 1/2 or 1/3 of the antropyloric mucosa, and stained more lightly for acetyl cholinesterase activity than those in the fundic mucosa. Transverse sections of pyloric glands were surrounded by cholinergic nerve fibers. Standard formaldehyde treatment showed endocrine-like cells with cytoplasmic granules arranged in a single layer around the gastric lumen, and some eterochromaffin cells. After exposure to HCl, the endocrine-like cells were strongly fluorescent, and the fluorescence of the enterochromaffin cells and adrenergic nerve fibers was strongly reduced or abolished. These findings suggest the direct involvement of cholinergic innervation in the secretion of pepsin and HCl acid. It is further concluded that gastrin release is controlled by the cholinergic nerve fibers innervating gastrin-containing cells.

6738 EVIDENCE OF NONVAGAL NEURAL STIMULATION OF CANINE GASTRIC ACID SECRETION. *(E.)* Tansy, M. F.; Probst, S. J.; Martin, J. S. (Temple Univ. Health Sciences Center, Philadelphia, Pa.). *Surg. Gynecol. Obstet.* 140(6):861-867, 1975.

Gastric secretory responses to central vagal stimulation were studied in male and female mongrel dogs during suppression of alpha-adrenergic effects. A cannula was inserted into the common bile duct of the fasted dogs for external diversion of the bile and a Thomas cannula was placed into the corpus of the stomach for collection of the gastric juice. Gastric acid secretion in response to electrical stimulation of the vagosympathetic trunks was studied before and after the i.v. administration of phenoxygenzamine hydrochloride, atropine sulfate, and burimamide hydrochloride. The response was also tested following surgical interruption of the splanchnic nerves and direct electrical stimulation of the peripheral ends of these nerves. Central vagal

stimulation subsequent to alpha-adrenergic blockade was associated with marked elevations in the total volume of gastric secretion and in acidity. The response was not blocked by a subsequent large dose of atropine. Acid secretion was never obtained from the gastric mucosa on phenoxybenzamine hydrochloride stimulation. The reflex increase in gastric acid secretion during alpha-adrenergic blockade was abolished by surgical interruption of the splanchnic nerves and reinstituted by direct stimulation of these nerves. The latter response was not completely blocked by atropine but was abolished by burimamide. Burimamide also abolished the elevated acid secretory response produced by multiple central stimulation of both vagi during alpha-adrenergic blockade. It is concluded that a heretofore unsuspected second neural pathway exists in the dog which is capable of influencing gastric acid secretion.

6739 EFFECT OF CONTINUOUS INFUSION OF PENTAGASTRIN ON LOWER ESOPHAGEAL SPHINCTER PRESSURE AND GASTRIC ACID SECRETION IN NORMAL SUBJECTS. *(E.)* Walker, C. O.; Frank, S. A.; Manton, J.; Fordtran, J. S. (Dallas Veterans Admin. Hosp., Dallas, Tex. 75216). *J. Clin. Invest.* 56(1):218-225, 1975.

The effect of a continous 1-hr infusion of pentagastrin on lower esophageal sphincter (LES) pressure was studied, and was correlated with the acid secretory response by stomach parietal cells. In the first period of study, isotonic saline was infused i.v. for 30 min (control). Pentagastrin was then infused i.v. for 1 hr. The third period was begun by replacing the pentagastrin infusion with saline for 40 min. The effects of different doses of pentagastrin were measured in different groups of from eight to 13 normal subjects (group dose-response studies); two subjects had a complete dose-response examination (four or five studies at each of seven doses; individual dose-response studies). Results of the group dose-response studies showed that gastric acid secretion was significantly stimulated by infusion of 0.025 µg/kg/hr and higher doses of pentagastrin. There was no significant elevation in LES pressure during 1-hr infusion of pentagastrin (0.004-12 µg/kg/hr). An i.v. bolus injection of pentagastrin (0.5 µg/kg/hr) together with 0.9 and 1.5 µg/kg/hr pentagastrin infusion significantly increased LES pressure. The results of the individual dose-response studies showed that in the first subject, LES pressure was increased from 37 to 50 mm of Hg with the 0.9 µg/kg/hr infusion of pentagastrin alone. The same infusion rate in the other subject increased LES pressure from 38 to 49 mm of Hg. In both these subjects, this dose of pentagastrin elicited secretion rates of gastric acid equal to those induced by a 12 µg/kg/hr infusion. The calculated half-maximal dose for acid secretion was 0.15 µg/kg/hr for the first subject and 0.35 µg/µg/hr for the second subject. There was no significant correlation between acid secretion rate and LES pressure. These results are in contrast to previous findings and suggest that serum gastrin may not be the major determinant of LES pressure.

6740 PLASMA SHEDDING BY THE CANINE OXYNTIC AND PYLORIC GLANDULAR MUCOSA INDUCED BY TOPICAL ACTION OF ACETYLCHOLINE: EFFECT OF ATROPINE AND PHYSOSTIGMINE. *(E.)* Davenport, H. W.; Kauffman, G. L., Jr. (Dept. Physiology, Univ. Michigan, Ann Arbor, Mich.). *Gastroenterology* 69(1):190-197, 1975.

The effects of various drugs on the acetylcholine-induced shedding of plasma proteins by the oxyntic glandular mucosa were studied in dogs with Heidenhain pouches or vagally denervated antral pouches. The fasted animals were injected i.v. with Evans blue (25 mg) and 40 ml of buffer was placed in the Heidenhain pouch or 20 ml was placed in the antral pouch. After 30 min, the volume of fluid in the pouch was measured and the fluid was analyzed for the presence of dye. This procedure was repeated following the placement of 20 or 40 ml of acetylcholine bromide in the pouch. The effects of topical and/or i.v. atropine sulfate, gallamine triethiodide, physostigmine, d-tubocurarine, and succinylcholine were also studied. Irrigation of the Heidenhain and antral pouches with acetylcholine caused the mucosa to shed plasma protein and caused the potential differences across the mucosa to fall. The response was dose-related, with the minimum effective concentration of acetylcholine bromide ranging from 0.1 to 1.0 g/100 ml. Topical atropine (50 mg/100 ml) completely blocked the effects of acetylcholine on plasma shedding and potential difference, a similar effect being produced by i.v. atropine (0.2 mg/kg). The minimal effective dose of atropine varied between 0.005 and 0.0125 mg/kg. The effect of low concentrations of acetylcholine was enhanced by concurrent irrigation with physostigmine (minimal effective dose, 0.3 mg/100 ml), but was not affected by concurrent irrigation (0.5 g/100 ml) with or i.v. (5 mg/kg) hexamethonium chloride. Similarly, the effects of acetylcholine on plasma shedding were not prevented by topical gallamine triethiodide (0.5 g/100 ml) or *d*-tubocurarine (0.15 g/100 ml). Topical succinylcholine chloride (1 g/100 ml) did not cause plasma shedding or a fall in potential difference. The data suggest that although high concentrations of acetylcholine are needed to cause plasma shedding, only a small amount of the applied acetylcholine acts at some relatively inaccessible site.

6741 FAILURE OF CHOLESTRYAMINE TO PREVENT BILE SALT INJURY TO MOUSE GASTRIC MUCOSA. *(E.)* Eastwood, G. L. (U.S. Naval Hosp., Philadelphia, Pa.). *Gastroenterology* 68(6):1466-1472, 1975.

The effects of cholestryamine on bile salt-induced injury to the mouse gastric mucosa were studied. Solutions of taurocholate or glycochenodeoxycholate, with or without added cholestyramine resin (9 mg/ml), were instilled into the stomachs of fasted mice at pH 1, 3, 5, or 7. Sections of the greater curvature were subsequently examined by light microscopy and graded as normal, mildly injured (spotty changes in the cellular staining characteristics of some surface epithelial cells), moderately injured (more generalized changes and/or disruption of the surface epithelium in several places), or severely injured (extensive mucosal destruction). Cholestyramine alone caused mild injury at pH 1, but produced no detectable injury at pH 7. At pH 1, all mice receiving 0.1 or 2 mM taurocholate, with or without cholestyramine, had gastric mucosal damage. At pH 3, 5, and 7, tauro-

cholate produced no changes. Glycochendeoxycholate caused injury at pH 1 and 3, the damage being slightly but insignificantly reduced by cholestyramine. The *in vitro* binding of 2 mM taurocholate by cholestyramine (4 mg/ml) was nearly complete at pH 3, 5, and 7, and at 20 mg/ml, cholestyramine was able to bind 89% of the bile salt at pH 1. The results suggest that for cholestyramine to be effective in binding the bile salts in the treatment of gastric ulcer, cholestyramine would have to be administered in greater quantity than the usual 4 g three times/day and/or the pH of the stomach would have to be maintained above 4-5 by the frequent administration of antacids.

6742 THE EFFECT OF VITAMIN A ON GASTRIC MUCUS AND STRESS ULCERATION IN THE RESTRAINED RAT. *(E.)* Wilson, S. E.; Hiatt, J. R.; Davis, R. S. (Veterans Admin. Wadsworth Hosp. Center, Los Angeles, Calif.). *Surg. Italy* 4(1):35-40, 1974.

Mucus production and the effects of vitamin A on mucus production and stress ulceration were studied in normal and restraint-stressed Wistar rats. In the first experiment, 120 rats were restrained for 12, 18, or 24 hr, with one-half of the rats serving as controls and the rest injected s.c. with aqueous vitamin A (5000 U) immediately prior to restraint. In the second experiment, 59 rats were fasted for 24 hr (controls) or restrained for 24 hr, and/or injected s.c. with aqueous vitamin A (5000 U). After both studies, the animals' stomachs were opened along the greater curvature and checked for evidence of ulceration; after the second study, the gastric mucosa was also analyzed for hexosamine, a primary constituent of mucus. In the first experiment, the ulcerative index in all animals increased with the duration of stress. In the animals pretreated with vitamin A, the number of ulcers was significantly lower after each period of stress restraint, particularly after 24 hr of restraint. In the second experiment, the average hexosamine content in the control mucosa was 0.56 mg/0.1 g while in untreated stressed rats, this value was significantly reduced to 0.36 mg/0.1 g. The mucosal hexosamine content in stressed rats pretreated with vitamin A did not differ significantly from that of the untreated stressed rats. Vitamin A did not significantly increase mucus levels in either the stressed or unstressed rats. It is concluded that vitamin A reduces the severity of acute mucosal ulceration in the stressed rat, that the hexosamine content of the superficial gastric mucosal layer is decreased with stress ulceration, and that vitamin A does not appear to significantly increase mucus production in stress ulceration.

6743 GASTRIC ACID SECRETION AND SLEEP STAGES DURING NATURAL NIGHT SLEEP. *(E.)* Stacher, G.; Presslich, B.; Starker, H. (1 Chir. Univ. Klinik, Alserstr 4, A-1097, Wien, Austria). *Gastroenterology* 68(6):1449-1455, 1975.

The relation between wakefulness and the different stages of natural night sleep and gastric acid secretion was studied in four healthy female volunteers for 11 nights. Measurement of gastric acid secretion was carried out by means of the intragastric titration technique and a telemetering capsule swallowed at the commencement of each experiment. Electroencephalogram recordings and eye movements were continuously monitored by monopolar scalp and bipolar facial leads. Acid output was determined prior to the onset of sleep, after awakening, during arousals and longer periods of wakefulness in the course of the night, and during the different stages of sleep. Compared with the waking state, sleep was associated with significantly reduced levels of acid secretion. Although there were no significant differences between acid secretion during sleep stages 1-4 and rapid eye movement (REM) sleep, acid secretion decreased in the deeper stages of sleep. During all REM phases, only small amounts of acid were produced. Arousal or periods of waking in the course of the night, as well as waking in the morning, were associated with significant increases in acid output. The high rate of secretion was maintained during the whole period after wakening, as long as the subject did not fall asleep again. Similar studies should be performed in duodenal ulcer patients.

6744 PYLORIC REFLUX GASTRITIS: THE OFFENDING AGENT. *(E.)* Delaney, J. P.; Broadie, T. A.; Robbins, P. L. (Univ. Minnesota Health Sciences Center, 412 S.E. Union St., Minneapolis 55455). *Surgery* 77(6):764-772, 1975.

The abilities of bile, pancreatic juice, and whole intestinal contents to induce morphologic changes in the canine gastric mucosa were compared. Full-thickness tubes were fashioned from the greater curvature of the canine stomach, pedicled on the short gastric vessels, and interposed in the upper jejunum of 12 dogs. In a second group of dogs, the segment of duodenum bearing the main pancreatic duct was anastomosed to the gastric tube, thereby exposing the stomach corpus mucosa to essentially pure pancreatic juice. In the third group of animals, bile was diverted over the gastric mucosa by ligating the common bile duct and anastomosing the gallbladder to the gastric tube. Biopsies of the tube and parent stomach were obtained at initial surgery and four months to two yr later; the specimens were compared with respect to parietal cell number, mucus cell number, inflammation, glandular disorder, and surface-cell hyperplasia. Exposure of the stomach mucosa to whole intestinal contents resulted in a 56% reduction in parietal cell density compared with a normal control group, while exposure to pancreatic juice resulted in a 49% reduction and exposure to bile in a 32% reduction. The degree of inflammation and mucus cell hyperplasia was also greater in mucosa exposed to intestinal juice than in mucosa exposed to pancreatic juice or bile; all three groups differed significantly from the controls. The overall gastritis scores did not differ significantly between the bile and pancreatic juice groups, but that of the intestinal juice group was significantly greater than those of the other two groups. The experimental gastric mucosa also differed from the control mucosa in the appearance of cysts in the deep glands of the mucosa, a disorderly appearance to the mucosa, and a reduction in chief cells; the experimental and control mucosa did not differ

in mucosal thickness. The changes in the experimental mucosa did not progress with time. The data suggest that gastritis may result from long-term exposure to a mixture of enzymes, detergent substances, and endogenous acid.

6745 INCREASED PLASMA GASTRIN LEVELS IN CONNECTION WITH INHIBITION OF GASTRIC ACID RESPONSES TO SHAM FEEDING FOLLOWING BULBAR PERFUSION WITH ACID IN DOGS. *(E.)* Nilsson, G. (Dept. Pharmacology, Karolinska Institutet, S-104 01 Stockholm 60, Sweden). *Scand. J. Gastroenterol.* 10(3):273-277, 1975.

The effect of bulbar acidification on plasma gastrin and gastric acid responses to sham feeding was studied in two mongrel dogs with esophageal fistulas, gastric cannula, and mucosal septal pouches of the fundic stomach (Pavlov type) and duodenal bulb. Gastric secretion from the Pavlov pouches was determined during a basal period and after stimulation by sham feeding of minced cooked beef in water; the volume was measured and the acidity determined by titration with 0.01 N NaOH. Perfusion of the bulbar pouches with 0.9% NaCl or 0.1 N HCl was performed throughout the experiment and pH determinations of the effluent perfusates were performed at 15-min intervals. Gastrin concentrations in blood samples taken every 15 min were measured by radioimmunoassay. The gastrin-like immunoreactivity measured in this way behaved like the porcine gastrin standard. Cross-reactivity with cholecystokinin-pancreozymin, the only natural peptide known to significantly cross-react with antigastrin antisera, was negligible. Perfusion of the bulbar pouches with 0.1 N HCl profoundly inhibited the acid output from the Pavlov pouches in response to sham feeding, the acid responses from the gastric fistulas being similarly inhibited. Sham feeding increased plasma gastrin concentrations in both the control and inhibitory experiments, but these concentrations were much higher in the inhibitory experiments than in the control. The data support the hypothesis that the bulbar mechanism inhibits acid secretion by interfering with the stimulatory action of gastrin at the HCl-producing glands.

6746 EFFECT OF ACID IN THE DUODENAL BULB ON ACID AND PEPSIN RESPONSES TO TEST MEAL IN DOGS. *(E.)* Nilsson, G. (Dept. Pharmacology, Karolinska Institutet, S-104 01 Stockholm 60, Sweden). *Scand J. Gastroenterol.* 10(3):279-282, 1975.

The effect of acid in the duodenal bulb on gastric acid and pepsin secretion was studied in five dogs with innervated pouches of the fundic stomach (Pavlov type) and the duodenal bulb. Gastric acid and pepsin output and pepsin concentration in gastric juice were determined under basal conditions. The dogs were then fed a cooked beef liver meal and in some cases the bulbar pouches were perfused with 0.1 N HCl (80 ml/hr). The volume of gastric juice, pH of the effluent perfusate, and pepsin concentration were determined in 15-min samples collected over the following three hr. Bulbar perfusion with acid profoundly inhibited the secretion of acid from the gastric pouches, the average reduction being 68% of basal secretion. The total output of pepsin was also reduced to 41% of basal levels during bulbar acidification; in addition, the pepsin concentration in the gastric juice was generally lower during bulbar perfusion with acid. The data suggest that secretin is not the humoral agent response for the inhibition of acid secretion during bulbar acidification.

6747 EFFECT OF BULBAR PERFUSION WITH ACID, HYPERTONIC SOLUTIONS, AND ACETYLCHOLINE ON GASTRIC ACID SECRETION IN DOGS. *(E.)* Nilsson, G. (Dept. Pharmacology, Karolinska Institut, S-104 01 Stockholm 60, Sweden). *Scand. J. Gastroenterol.* 10(3):283-287, 1975.

The effects of bulbar perfusion with 0.1 N HCl, hypertonic solutions of 40% glucose, 40% peptone, or 40% NaCl, and 0.1% acetylcholine chloride on gastric acid secretion were studied in three mongrel dogs with Pavlov pouches of the fundic stomach and proximal portion of the duodenum; one dog was also provided with an isolated pouch of the distal duodenum. Beginning two hr before the bulbar perfusions, pentagastrin (40 µg/hr) in 0.9% saline was given as a continuous i.v. infusion for five hr. The gastric acid secretions were collected in 15-min samples. Bulbar perfusion with 0.1 N HCl profoundly inhibited acid secretion from the Pavlov pouches, while perfusion with glucose, NaCl, or peptone solutions had no significant influence on the average acid output. Perfusion with acetylcholine produced a transient inhibition of gastric secretion, the degree of inhibition varying from dog to dog. Perfusion of the distal duodenal segment in one dog with glucose did not significantly influence the gastric acid output. It is concluded that hypertonic solutions are not activators of the bulbar inhibitory mechanism which responds to reductions in the intrabulbar pH. Inhibition following bulbar perfusion with acetylcholine may indicate that the liberation of a hypothetical humoral agent, bulbogastrone, is to some extent under cholinergic control.

6748 IN VIVO STUDIES ON THE NEUTRALIZING EFFECT OF ANTACIDS USING THE HEIDELBERG CAPSULE. *(E.)* Ekenved, G.; Walan, A. (Res. Lab., AB Hassle, Molndal, Sweden). *Scand. J. Gastroenterol.* 10(3): 267-272, 1975.

The effects of various antacid preparations on gastric pH were studied in six healthy volunteers, aged 23-43 yr. The intragastric pH was measured by the Heidelberg radiotelemetry capsule method and the aspiration technique. The *in vitro* rate of reaction between human gastric juice and the four antacid preparations [a liquid preparation, a chewable tablet (tablet A), and 2 tablets (tablets B and C) designed to be swallowed whole] was assayed by titration at constant pH. The preparations were given to fasting subjects in a dosage corresponding to a neutralizing capacity of 50-60 mEq HCl. At low pH levels (less than 2), the Heidelberg capsules recorded lower values than were obtained with the aspiration technique, but when the pH response to an antacid dose was studied the two techniques give concordant re-

sults. The liquid antacid preparation and tablet A give almost equivalent results, with a short latency period and a duration of action of more than one hr (mean 69 min and 82 min, resp.). Tablets B and C gave less prompt effects with a shorter duration of action (mean 45 min for both). The clinical interpretation of these results should be limited to situations involving an empty stomach.

6749 EFFECT OF URIDINE DIPHOSPHO-N-ACETYLGLUCOSAMINE AND SODIUM SALICYLATE ON L-GLUTAMINE-D-FRUCTOSE-6-PHOSPHATE AMINOTRANSFERASE ACTIVITY FROM RAT GASTRIC MUCOSA. *(E.)* Chan, J.; Lee, K. H. (Sch. Pharmacy, Univ. California, San Francisco 94143). *J. Pharm. Sci.* 64(7):1182-1185, 1975.

The mechanisms of action of sodium salicylate and uridine-5'-diphospho-*N*-acetylglucosamine on L-glutamine-D-fructose-6-phosphate aminotransferase prepared from Sprague-Dawley rat gastric mucosa were studied, as were interactions between the two inhibitors. The effect of these two inhibitors on enzyme activity was determined by the rate of glucosamine formation in mucosal supernatant protein fractions during incubation in the presence of L-glutamine and glucose-6-phosphate. At 10-20 mM, sodium salicylate reversibly inhibited aminotransferase activity by competing with glucose-6-phosphate. At higher concentrations, salicylate inactivated the enzyme irreversibly, with an inactivation rate following first order kinetics with response to enzyme concentration. Uridine-5'-diphospho-*N*-acetylglucosamine, an endogenous feedback inhibitor, also inhibited the aminotransferase-catalyzed reaction by competing with glucose-6-phosphate; its inhibiting activity was 1000 times that of salicylate. Uridine-5'-diphospho-*N*-acetylglucosamine reduced the salicylate inhibition of the enzymic reaction and protected the enzyme from salicylate-induced irreversible inactivation. At a fixed concentration of uridine-5'-diphospho-*N*-acetylglucosamine ($7 \times 10^{-6}$ M), increasing concentrations of salicylate produced an increase in enzyme activity as compared with the control. Fructose-6-phosphate at $10^{-2}$ M also protected the enzyme against inactivation by 40 mM salicylate, while glutamine offered no such protection. The data suggest that sodium salicylate and uridine-5'-diphospho-*N*-acetylglucosamine apparently bind to the same site on the enzyme.

6750 ELECTROPHYSIOLOGICAL EFFECTS OF BURIMAMIDE AND 16,16-DIMETHYL PROSTAGLANDIN $E_2$ ON THE CANINE GASTRIC MUCOSA. *(E.)* Bowen, J. C.; Kuo, Y. J.; Pawlik, W.; Williams, D.; Shanbour, L. L.; Jacobson, E. D. (Univ. Texas Medical Sch., 6400 W. Cullen, Houston 77025). *Gastroenterology* 68(6):1480-1484, 1975.

The electrophysiological effects of two potent inhibitors of gastric acid secretion, burimamide and 16,16-dimethyl prostaglandin $E_2$ (dm-$PGE_2$), were determined in an *in vivo* histamine-stimulated canine stomach preparation and an *in vitro* canine gastric mucosal preparation. In the *in vivo* preparations, a flap of stomach from the oxyntic gland area was secured within a partitioned chamber bathed with isotonic saline. Submaximal acid secretion was produced by i.v. histamine infusion (1.5 µg/kg-min). The transmural potential difference (PD) across the stomach preparation was determined before and after i.v. injection of a burimamide bolus (8.28 mg) or i.v. infusion of dm-$PGE_2$ (0.005 µg/kg-min for 1 hr). In the *in vitro* preparations, paired segments of gastric mucosa were mounted in identical flux chambers. Unidirectional fluxes of labeled sodium and chloride were determined before and after the addition of burimamide ($3 \times 10^{-4}$M) or dm-$PGE_2$ (0.02 or 0.2 µg/ml) to the bathing solution on the serosal surface. In the *in vivo* preparation, burimamide caused a decrease in acid secretion, an increase in PD, and no significant change in the relative resistance (R). Dm-$PGE_2$ also inhibited acid secretion and increased the PD, but it also increased R. In the *in vitro* preparation, the unidirection flux of sodium from mucosa to serosa increased after dm-$PGE_2$ but not after burimamide. The passive sodium fluxes and unidirectional chloride fluxes were not altered after either agent. The data suggest that increased active transport of sodium from mucosa to serosa is at least partially responsible for the observed increase in transmural PD after dm-$PGE_2$, an agent which also decreases $H^+$ transport. With burimamide, the increased PD was due primarily to the inhibition of $H^+$ secretion.

6751 EFFECT OF CALCITONIN ON SERUM GASTRIN CONCENTRATION AND COMPONENT PATTERN IN MAN. *(E.)* Frahrenkrug, J.; Hornum, I.; Rehfeld, J. F. (Bispebjerg Hosp., Copenhagen, Denmark). *J. Clin. Endocrinol. Metab.* 41(1):149-152, 1975.

The effects of synthetic salmon calcitonin on serum concentrations and distribution of the four main forms of gastrin and on serum concentrations of total and ultrafiltrable calcium were studied in nine normal subjects and three patients with pernicious anemia. In the normal subjects, the mean basal serum gastrin concentration was 26 pM/liter, as measured radioimmunochemically. Administration of calcitonin (0.7 Medical Research Council U/kg, i.v.) resulted in a significant decrease in serum gastrin levels measured at 20, 45, 60, and 90 min postinjection. Calcitonin given at the beginning of a protein-rich meal lowered the gastrin response significantly at 5-30 min after injection. In the three patients with pernicious anemia, serum gastrin concentrations were 1286 pM/liter before and 628 pM/liter after calcitonin injection. Sephadex gel filtration of sera from the three patients revealed that while calcitonin lowered the concentrations of all four main gastrin components, the decrease was most pronounced for the small components III and IV (gastrin-17 and gastrin-13). Calcitonin produced no significant changes in serum calcium concentrations or in unfilterable calcium concentrations calculated from calcium and albumin concentrations. No side effects were noted. The data suggest that calcitonin acts directly on the gastrin cells in the gastric antrum and duodenum.

6752 EFFECT OF CARBACHOLINE AND URECHOLINE ON PENTAGASTRIN-STIMULATED GASTRIC SECRETION IN HEALTHY SUBJECTS. *(E.)* Roland, M.; Berstad, A.; Liavag, I. (Aker Univ. Hosp., Oslo 5, Norway). *Scand. J. Gastroenterol.* 10(4):357-362, 1975.

The effect of two cholinomimetics, carbacholine and urecholine, on the gastric mucosa were studied. Pentagastrin (0.15, 1.5 and 15 µg/kg/hr) either alone or in combination with carbocholine (2 µg/kg/hr) or urecholine (60 µg/kg/hr) was administered i.v. in each of six healthy subjects. Tests were performed in random order on different days. Each of eight 15-min samples (one basal and seven postinfusion) was analyzed for volume, pH, $H^+$, and pepsin. After pentagastrin alone there was a significant increase in acid output with 0.15 to 1.5 µg/kg/hr, but no further increase with 15 µg/kg/hr. At all pentagastrin doses, acid output was higher after pentagastrin plus urecholine than after pentagastrin plus carbacholine, but the differences were not significant. With 0.15 µg/kg/hr pentagastrin alone, pepsin output was lower than with both of the combined infusions, but only the difference between pentagastrin plus urecholine and pentagastrin alone was significant. After pentagastrin alone there was a significant increase in gastric juice volume from the lowest to the middle dose and a slight inhibition after the third dose. When carbacholine or urecholine was added to pentagastrin, the volume of gastric juice increased significantly from the lowest to the highest dose. At all dose steps of pentagastrin, the volume of gastric juice was higher after infusion of urecholine than of carbacholine, and at the two lowest doses the differences were significant. The volume of gastric juice was also higher after pentagastrin plus urecholine than after pentagastrin alone, and the differences were significant at the lowest and the highest doses. It is suggested that the cholinimimetics increased the sensitivity of the parietal cells to pentagastrin stimulation.

6753 EFFECTS OF CYCLIC ADENOSINE 3':5'-MONOPHOSPHATE AND RELATED AGENTS ON ACID SECRETION BY ISOLATED RABBIT GASTRIC MUCOSA. *(E.)* Fromm, D.; Schwartz, J. H.; Quijano, R. (Harvard Medical Sch., Boston, Mass.). *Gastroenterology* 69(2):453-462, 1975.

The effects of various adenosine phosphate compounds, theophylline, histamine, and metiamide on steady states of acid secretion by isolated New Zealand rabbit fundic mucosa were studied. The tissue was mounted on a Lucite half-chamber and perfused with Ringer's solution. Steady-state rates of luminal acid secretion were measured by the pH stat method and the transmural electrical potential difference (PD) and short-circuit current (Isc) were also measured. The steady acid secretory and PD responses to dibutyryl AMP (DB-AMP), cyclic AMP, 2':3'-AMP, 5'-AMP, ATP, histamine, theophylline, and/or metiamide added to the serosal bathing solution were then determined. Cyclic AMP (5 mM or greater), DB-AMP (more than 0.45 mM), histamine (0.05 mM or greater) and theophylline (greater than 3 mM) increased the rate of acid secretion, and the addition of theophylline in a concentration which had no stimulatory effect (less than 3 mM) reduced the effective concentrations of cyclic AMP or histamine required for stimulation of acid secretion. Measurements of lactate, pyruvate, and $CO_2$ indicated that the increases in acid secretory rats were predominantly due to $H^+$ and not to the accumulation of organic acid in the luminal bathing solution. ATP (0.75 mM) and 5'-AMP (4 mM), but not 2':3'-AMP (10 mM), also stimulated acid secretion. Metiamide (3 mM) prevented the stimulatory effects of histamine and ATP, but it did not prevent the stimulatory effects of DB-AMP, theophylline, or 5'-AMP. The data suggest that cyclic AMP is involved in the regulation of acid secretion by the rabbit stomach and are consistent with the hypothesis that histamine and ATP require adenylate cyclase activity for stimulation of acid secretion and 5'-AMP inhibiting phosphodiesterase activity.

6754 EFFECTS OF DRUGS INFLUENCING GASTRIC SECRETION ON THE QUANTITATIVE HISTOLOGICAL DISTRIBUTION OF CYCLIC ADENOSINE 3':5'-MONOPHOSPHATE IN THE RAT STOMACH. *(E.)* Katsumata, Y.; Glick, D. (Stanford Res. Inst., Menlo Park, Calif.). *Gastroenterology* 69(2):409-415, 1975.

Studies were undertaken to clarify the role of cyclic AMP in acid secretion in the rat stomach and to quantitate the effects of gastric stimulatory and inhibitory drugs on the cyclic AMP concentrations within the glandular stomach. Sixty min before sacrifice, fasted (24 hr) male Sprague-Dawley rats were injected s.c. with the secretion-stimulating drugs pentagastrin (250 µg/kg), urecholine (100 µg/kg), or histamine (2 or 40 mg/kg), or with the inhibitors atropine sulfate (2 mg/kg) or prostaglandin $E_2$ ($PGE_2$, 1 mg/kg). In some experiments, these drugs were combined with theophylline (200 mg/kg, i.p., 15 min before sacrifice), a drug that prevents enzymatic degradation of cyclic AMP. Controls received s.c. or i.p. injections of 0.9% NaCl, the solution in which the test compounds were administered. Cyclic AMP concentrations in circular fresh-frozen microtome sections, representing the various histologic regions of the glandular stomach, were measured by the firefly luminescence method. The peak cyclic AMP concentrations in the NaCl-injected controls were found in the parietal-mucous neck cell region (3.3 pM/mg wet weight; 0.11 pM/µg protein-nitrogen). Pentagastrin and urecholine alone increased the peak values slightly (both about 4 pM/mg wet weight; 0.15 pM/µg protein-nitrogen). Theophylline alone had a slightly greater effect (5.4, 0.22), but theophylline given with pentagastrin or urecholine greatly elevated the values (8.3, 0.31). In addition, urecholine or pentagastrin plus theophylline generated two approximately equal cyclic AMP concentration peaks (about one-half the parietal-mucous neck cell peak value) in the chief cell and muscle regions. Histamine at 40 mg/kg slightly suppressed the parietal-mucous neck cell concentrations (2.7, 0.11), but at 2 mg/kg, it elevated these values significantly; histamine (2 mg/kg) plus theophylline had an even greater effect (9.1, 0.32). The other histological regions were not significantly influenced by histamine. Neither atropine nor $PGE_2$, alone or in combination with theophylline, had much influence on the parietal-mucous neck cell cyclic AMP levels; but both caused significant increases in the chief cell and muscle levels. The data indicate a cyclic AMP involvement in the stimulation of acid secretion in the rat stomach.

6755 CYCLIC NUCLEOTIDE REGULATION OF GASTRIC ACID SECRETION. *(E.)* Charters, A. C.; Chandler, J. G.; Flamant, Y. M.; Faulkner, M. A.; Orloff, M. J. (Univ. California, San Diego Sch. Medicine, La Jolla). *Surg. Forum* 24:361-363, 1973.

Intracellular cyclic AMP concentrations and adenyl cyclase and phosphodiesterase activities were measured in the frog isolated gastric mucosa in the basal state and during pentagastrin-stimulated acid secretion. The gastric mucosa from *Rana pipiens* were mounted on plastic syringe barrels and immersed in a nutrient serosal solution; unbuffered mucosal solution was added to the syringe barrel. Acid secretion was measured before and after the addition of pentagastrin ($10^{-6}$ M) to the serosal solution. Cyclic AMP levels were examined at the midportion of the secretory response curve for pentagastrin, and adenyl cyclase and phosphodiesterase activities were estimated from the cyclic AMP levels. Pentagastrin elicited a mean 74% increase over basal acid secretion. In the stimulated, but not the control, mucosa, the intracellular cyclic AMP concentration correlated significantly with the acid secretory response. Adenyl cyclase activity and the cyclic AMP concentration were significantly related in both the unstimulated and control mucosa; phosphodiesterase activity did not correlate with cyclic AMP levels and there was no apparent relation between acid secretion and phosphodiesterase activity. The data support the hypothesis that the adenyl cyclase-cyclic AMP system is the intracellular mediator of pentagastrin-stimulated acid secretion.

6756 CYCLIC GMP IN STIMULATED GASTRIC MUCOSA. *(E.)* Eichhorn, J. H.; Salzman, E. W.; Silen, W. (Harvard Medical Sch., Boston, Mass.). *Surg. Forum* 24:363-365, 1973.

The effects of cholinergic stimuli on the gastric mucosal levels of cyclic guanosine 3'5'-monophosphate (cGMP) were studied using strips of fundic gastric mucosa from adult mongrel dogs. Prior to removal of the mucosal strips, the dogs were subjected to: electrical stimulation of the distal transected vagus trunks above the diaphragm; infusion of acetylcholine (ACh, 0.05 mg/min) into the celiac artery; pretreatment with atropine (1.0 mg/5 kg) before electrical stimulation of the vagi; or i.v. pentagastrin infusion (10 µg/kg/hr). The mucosal strips were acid extracted and fractionated on a formate ion-exchange resin column. The cGMP-containing fraction was assayed by a double radioimmune method. Electrical stimulation of the vagus nerves produced a marked increase in the cGMP content of the fundic mucosa, an effect which was blocked by pretreatment with atropine. ACh infusion also produced significant increases in the cGMP concentration, but pentagastrin had no such effect. The data demonstrate an *in vivo* association between cholinergic stimuli and an increase in gastric mucosal cGMP. Combined with previous results, they suggest that cGMP may serve as a mediator of cholinergic stimuli, analogous to the postulated "second messenger" role of cAMP for adrenergic stimuli.

6757 EFFECT OF DIAZEPAM ON UNSTIMULATED AND ON STIMULATED GASTRIC SECRETION. *(E.)* Bennett, P. N.; Davies, P.; Frigo, G. M.; Weerasinghe, M. T.; Lennard-Jones, J. E. (Univ. Coll. Hosp., London, England). *Gut* 15(11):101-103, 1974.

The effect of i.v. diazepam on unstimulated and pentagastrin-stimulated gastric secretion was studied in 12 normal male and female subjects. Gastric secretion was collected by suction pump through a nasogastric tube placed in the fasted subjects. Pentagastrin (6 µg/kg/hr) was infused for 2.25 hr. Serial collections of gastric juice were made at 15-min intervals in the unstimulated and pentagastrin-stimulated subjects, then were repeated in both groups during the i.v. administration of diazepam (0.14 mg/kg). The volume of secretion was reduced in all six unstimulated subjects following diazepam, and in five subjects the acid content was reduced. However, diazepam had no significant effect on the volume of secretion or acid content in the pentagastrin-stimulated subjects. The results indicate that diazepam may reduce nonstimulated gastric secretion by a centrally mediated action; this effect may be of advantage in peptic ulcer therapy.

6758 RELEASE OF IMMUNOREACTIVE GASTRIC INHIBITORY POLYPEPTIDE (IR-GIP) BY ORAL INGESTION OF FOOD SUBSTANCES. *(E.)* Cleator, I. G. M.; Gourlay, R. H. (Dept. Surgery Physiology, Univ. British Columbia, Vancouver, B. C., Canada). *Am. J. Surg.* 130(2):128-135, 1975.

The purpose of this study was to examine the pattern of immunoreactive gastric inhibitory polypeptide (IR-GIP) release in man after oral ingestion of various food substances in an attempt to find a specific releaser of IR-GIP for use in further studies of the role of GIP in physiologic and pathologic conditions. All studies were performed in adult subjects after an overnight fast. The subjects had no history of gastrointestinal diseases and no family history of diabetes, and they were within 10% of ideal body weight. Each study was carried out in at least six subjects, except an i.v. porcine GIP infusion study, in which three subjects had two tests each. The mean fasting IR-GIP level in 107 normal subjects was 410 ± 23 pg/ml. Lipomul (an oleic acid suspension), glucose (Pal-a-dex 100), galactose, and leucine, all given p.o., significantly elevated the serum IR-GIP level in man. Inhibition of acid and pepsin secretion (enterogastrone effect) was demonstrated after elevation of serum IR-GIP levels by introduodenal administration of Lipomul and by i.v. infusion of porcine IR-GIP. Increases in serum IR-GIP levels induced by p.o. glucose or i.v. porcine GIP were associated with increases in serum immunoreactive insulin levels. I.v. glucose had no effect on the serum IR-GIP level but produced an increase in the immunoreactive insulin level. Concurrent administration of Lipomul and i.v. glucose induced a significant decrease in the serum IR-GIP level. It is postulated that GIP releases insulin and that insulin, in turn, inhibits GIP release.

6759 THE INTESTINAL PHASE OF GASTRIC SECRETION: A PHARMACOLOGICAL PROFILE OF ENTERO-OXYNTIN. *(E.)* Way, L. W.; Cairns, D. W.; Deveney, C. W. (Dept. Surgery, Univ. California, San Francisco 94121). *Surgery* 77(6):841-850, 1975.

The pharmacologic properties of entero-oxyntin, the hormone responsible for the intestinal phase of gastric secretion, were studied in male and female mongrel dogs prepared with antrectomies, gastrojejunostomies, and Heidenhain pouches. A Gregory cannula was placed in the Heidenhain pouch and a Thomas cannula was placed in the gastric remnant as a gastric fistula. The dogs were fed a meal of cooked liver with 5% bone meal and the gastric acid was collected in continuous 15-min samples. In subsequent experiments, the dogs were given i.v. histamine dihydrochloride (0.10 mg/kg/hr for 3.5 hr), i.v. pentagastrin (8 µg/kg/hr for 3.25 hr), the octapeptide of cholecystokinin (OP-CCK, 400 ng/kg/hr for 2.5 hr i.v.), i.v. cholecystokinin (4 U/kg/hr for 1 hr), s.c. bethanecol (0.1 mg/kg/hr for 3 hr), i.v. secretin (2 U/kg/hr for 1 hr), i.v. atropine (0.06 mg/kg bolus), and i.v. metiamide (3 µM/kg bolus) during the period of maximal feeding-stimulated acid secretion. Acid secretion from the Heidenhain pouch was stimulated by feeding with no increase in the serum gastrin concentrations. Simultaneous administration of pentagastrin, histamine, OP-CCK, or bethanecol potentiated the acid secretion, while atropine and metiamide inhibited secretion; secretin and glucagon were without significant effect. The results suggest that entero-oxyntin differs from antral gastrin, histamine, and cholecystokinin-pancreozymin, and that it activates a separate set of receptors on the parietal cells. Secretagogue potentiation may normally be important in determining the acid secretory response to a meal.

6760 DOSE-RESPONSE RELATIONSHIP OF GRADED DOSES OF INTRAVENOUS HISTAMINE INFUSION ON GASTRIC ACID SECRETION IN MAN. *(E.)* Naik, S. R.; Bajaj, S. C.; Goyal, R. K.; Chuttani, H. K. (Maulana Azad Medical Coll., New Delhi, India). *Digestion* 11(5-6):321-332, 1974.

The dose-response relation between i.v. histamine and gastric acid output was studied in nine healthy male adults of North Indian origin. The stomach contents were removed by nasogastric tube from the fasted subjects. Basal secretion was then measured and 50 mg of mepyramine maleate was administered i.m. Histamine (20-100 µg/kg/hr) was administered as histamine acid phosphate *via* constant i.v. infusion. Gastric secretions were collected every 15 min for three hr, and the acid content determined by titration with 1 N NaOH. Following i.v. histamine, the acid output gradually increased during the first 60 min and a steady state of acid secretion was reached for all dose levels during the second hr. Acid output increased significantly with increasing doses of histamine up to 80 µg/kg/hr; although acid output with 100 µg/kg/hr was greater than with 80 µg/kg/hr, this difference was not significant. Estimations of Vmax and the dose of histamine producing a response equal to 50% of the $V_{max}$ ($K_m$) by three different transformations of the Michaelis-Menten equation gave somewhat different values for these constants, and all values differed slightly from those estimated directly with curvilinear regression. The plot used by Hirschowitz gave the best results: $V_{max}$ = 44.07 mEq/hr; $K_m$ = 34.46 µg/kg/hr. Data analysis using dose of histamine independent of body weight gave a poorer fit to the regression line than the data obtained using histamine dose on the basis of body weight, suggesting that dosage should be determined on the basis of body weight. The value of $K_m$ in the Indian subjects was almost six times the value obtained in Western subjects, indicating the relative insensitivity of the parietal cells of the former to histamine.

6761 EFFECT OF HYDROCORTISONE ON GASTRIC SECRETION AND SERUM GASTRIN IN DOGS. *(E.)* Watson, L. C.; Reeder, D. D.; Thompson, J. C. (Univ. Texas Medical Branch, Galveston). *Surg. Forum* 24:354-356, 1973.

The effects of acute and chronic hydrocortisone treatment on the serum gastrin response to a standard meal and the acid secretion from a denervated pouch were studied in adult dogs. In the acute studies, the antrum was isolated and hydrocortisone acetate (50, 100, or 200 mg) was injected at 45-min intervals. The gastrin concentration in the venous blood was determined by radioimmunoassay. In the chronic studies, dogs with Heidenhain pouches were given a standard 500-g meat meal and the gastric secretions and serum gastrin concentrations were determined at 30-min intervals for three hr. Hydrocortisone was then injected i.m. at 100 mg/day for five days and the effects of food on acid secretion and serum gastrin levels were redetermined. Hydrocortisone produced no significant changes in serum gastrin levels (basal level 72 pg/ml) in the acute study. In the chronic study, the mean basal serum gastrin level was 98 pg/ml; after 5 days of hydrocortisone treatment, this rose significantly to 121 pg/ml. The three-hr integrated serum gastrin output after food was 10.2 ng/min/ml, which rose significantly to 16.1 ng/min/ml after five days of hydrocortisone treatment. The acid output after food was also significantly elevated after hydrocortisone. These findings provide information on the pathogenesis of steroid-induced ulcerations.

6762 EFFECTS OF 13-Nle-MOTILIN IN MAN — INHIBITION OF GASTRIC EVACUATION AND STIMULATION OF PEPSIN SECRETION. *(E.)* Ruppin, H.; Domschke, S.; Domschke, W.; Wunsch, E.; Jaeger, E.; Demling, L. (Dept. Med., Univ. Erlangen-Nurnberg, Erlangen, West Germany). *Gut* 16(1):199-202, 1975.

The effects of i.v. 13-norleucine-motilin (13-nle-motilin) on gastric emptying and pepsin secretion were studied in three healthy men. Gastric fasting contents were removed from the fasted subjects by a gastric tube placed with its tip in the upper antrum. The stomach was then rinsed and 300 ml of test solution (10% mannitol in 0.5 M citric acid-phosphate buffer, pH 3.0) was instilled intragastrically. Polyethylene-$^{14}$C glycol served as a nonabsorbable marker. 13-Nle-motilin was administered on alternate days by

continuous i.v. infusion in dosages of 0.1, 0.2, and 0.4 µg/kg-hr. The gastric contents were mixed by withdrawal and reinstillation. Gastric volumes, radioactivity of 15-min gastric samples, and pepsin activity in the samples were determined. Gastric emptying was slowed in a dose-dependent fashion by increasing doses of 13-nle-motilin. This was indicated by increasing 'half-lives' and 'starting indices' of the gastric emptying process, and by decreasing pyloric loss rates, respectively. The gastric pepsin output rose markedly from the basal level during i.v. 13-nle-motilin infusion. These results, in conjunction with previous data, suggest different susceptibilities of gastric and duodenal muscles to 13-nle-motilin. They also suggest that a common receptor site for secretin and motilin may be present in the stomach.

6763 THE COMBINED EFFECT OF PENTAGASTRIN AND MAGNESIUM ON GASTRIC ACID SECRETION IN MAN. *(E.)* Christiansen, J. (Bispebjerg Hospital, Copenhagen, Denmark). *Gut* 16(1):203-205, 1975.

To determine the mechanism by which magnesium acts on gastric acid secretion, the combined effects of pentagastrin and magnesium on gastric acid secretion were studied in 10 healthy male and female volunteers. The gastric secretion was collected *via* a Levin tube in the fasted subjects, after which pentagastrin (0.5 µg/kg/hr) was administered over a three-hr period by constant i.v. infusion. After two hr of pentagastric infusion, when a secretory plateau had been obtained, magnesium sulfate (0.4 mEq $Mg^{++}$/kg/hr) was infused for one hr. The volume of the secretion collected for each 15-min period and the concentrations of $H^+$ and $^{51}Cr$-labeled edetic acid were determined. Blood samples were also taken every 15 min for magnesium determination and at 0, 120, and 210 min for calcium determination. Pentagastrin infusion resulted in a secretory plateau which was unaltered during magnesium infusion; this applied to volume secretion as well as to acidity and acid output. Serum magnesium was elevated during magnesium infusion, but serum calcium concentration was unchanged throughout the experiment. The data could be explained by a dose-dependent relation between gastrin, magnesium, and calcium on acid secretion.

6764 EFFECT OF GASTRIC SECRETORY INHIBITORS ON THE GASTRIC MUCOSAL BARRIER. *(E.)* O'Brien, P. E.; Carter, D. C. (Royal Infirm., Edinburgh, Scotland). *Gut* 16(6):437-442, 1975.

The effects of the synthetic prostaglandin 16, 16-dimethyl-$E_2$ methyl ester (16-diMe-$PGE_2$) and the histamine $H_2$-receptor antagonist, metiamide on the gastric mucosal barrier were studied in male dogs prepared with antrectomies and Heidenhain pouches. At the start of each of six 30-min experimental periods, basal solution or a test solution was instilled into the pouches of the fasted dogs. The fluid was sampled at the beginning and end of each period and assayed for $Na^+$ and $H^+$ concentrations. The basal solution consisted of 80 mEq/liter of HCl made isotonic with NaCl. The test solutions consisted of: basal solution with 20 mM sodium taurocholate replacing an equal amount of NaCl; and basal or taurocholate solution containing 30 µg/20 ml of 16-diMe-$PGE_2$ or 220 mg/20 ml of metiamide. In some experiments, the basal or taurocholate solution was instilled into the pouch and 16-diMe-$PGE_2$ (7.5 or 30 µg) or metiamide (75 mg) was given by i.v. injection. A low and stable ionic flux across the gastric mucosal barrier occurred in the basal state, a marked and highly significant increase in both $H^+$ back diffusion and $Na^+$ output being observed with the addition of taurocholate to the basal solution. When instilled into the Heidenhain pouch, 16-diMe-$PGE_2$ caused a marked increase in the rate of $Na^+$ output and a moderate increase in the rate of $H^+$ back diffusion from the pouch; both changes were highly significant. Bleeding from the pouch after administration of 16-diMe-$PGE_2$ occurred in four of six experiments. I.v. 16-diMe-$PGE_2$ did not alter the mucosal barrier or the response of the mucosa to sodium taurocholate. Metiamide did not affect the mucosal barrier or the response to taurocholate when given i.v. or instilled into the pouch. It is likely that the damaging effect of intragastric 16-diMe-$PGE_2$ reflects a specific biological action rather than the nonspecific chemical effect of a fatty acid. It is unlikely that histamine $H_2$ receptors play a significant role in the ionic fluxes observed after gastric mucosal barrier damage.

6765 SECRETIN EFFECT ON GASTRIN, GASTRIC SECRETION IN DOGS WITH CHRONIC ANTRAL STIMULATION. *(E.)* Nasca, S.; Mignon, M.; Gramatica, L.; Accary, J. P.; Bonfils, S. (Unite Recherches Gastroenterologie, Institut National Sante, 75877 Paris Cedex 18, France). *Am. J. Physiol.* 228(6):1775-1781, 1975.

The effects of exogenous secretin on plasma gastrin levels and acid secretion were studied in dogs under conditions of chronic antral gastrin hyperproduction; the pepsigogue effect of secretin at various levels of secretin-induced acid suppression was also studied. Adult beagles were prepared with a Heidenhain pouch and an antral transposition onto the colon; gastrointestinal continuity was restored by an end-to-side gastrojejunostomy. Antrocolic transposition resulted in a marked increase in fasting plasma gastrin concentration and sustained high levels of acid secretion, acid output and plasma gastrin being significantly correlated in the fasting state. A marked increase in pepsin production accompanied the acid hypersecretion, but the pepsin output was not correlated with the plasma gastrin levels. Infusion 0.5, 1, and 2 U/kg/hr of secretin induced a dose-related depression in acid secretion and plasma gastrin; the reduction in acid output was two-fold greater than that in plasma gastrin and was related to reductions in both acid concentration and secretory volume. The fasting acid output correlated significantly with the remaining acid output during secretin infusion and with the maximal reduction in acid output after secretin. Despite the reduction in the secretory volume of the pouch after secretin, secretin at 0.5 and 1 U/kg/hr produced a 1.5- and 2-fold increase in pepsin output, resp. Secretin at 2 U/kg/hr decreased both the secretory volume and pepsin output. If the

physiological release of secretin in dogs does not exceed the equivalent of the lowest dose studied, these results indicate that acid inhibition is a physiological action of secretin: the effect on the circulating gastrin concentration appears to be pharmacological.

6766 GASTRIC ACID RESPONSE TO ANTRUM DISTENSION IN MAN. *(E.)* Bergegardh, S.; Olbe, L. (Kir. klin. II, Sahlgrenska sjukhuset, S-413 45 Goteborg, Sweden). *Gut* 16(1):171-176, 1975.

Gastric acid secretion in response to graded distension of the antrum was studied in six healthy subjects (four men), seven men with quiescent duodenal ulcers, 14 patients (12 men) with active duodenal ulcers, and five patients (two men) with gastric ulcers. A double lumen nasogastric tube was placed in the fasted subjects with its tip in the oral portion of the antrum. The antrum was distended by a balloon attached to the tip of the nasogastric tube and filled with increasing volumes of water (50, 100 and 150 ml) mixed with contrast medium. The stomach was continuously perfused with a phenol red solution. The volume and pH of the collected gastric contents were determined every 15 min, as was the amount of acid recovered and the phenol red concentration in the gastric contents. To determine the acid response to exogenous gastrin, pentagastrin was infused i.v. at 90 µg/hr for 45 min followed by 300 µg/hr for a further 45 min. In the healthy subjects, the mean basal acid secretion was 1.6 mEq/15 min, the mean peak acid output following pentagastrin was 9.1 mEq/15 min, and antrum distension did not significantly increase gastric acid secretion. In the quiescent duodenal ulcer patients, the mean basal acid secretion was 1.9 mEq/15 min, the mean peak acid output in response to pentagastrin was 12.0 mEq/15 min, and antrum distension did not significantly increase gastric secretion. In the active duodenal ulcer patients, the mean basal acid secretion was 2.3 mEq/15 min, the mean peak acid output following pentagastrin was 12.4 mEq/15 min, and antrum distension significantly increased gastric acid secretion. In the gastric ulcer patients, the mean basal acid secretion was 0.1 mEq/15 min, the mean peak acid output in response to pentagastrin was 5.1 mEq/15 min, and antrum distension resulted in a slight, but rarely significant, increase in gastric acid secretion. The pH of the gastric contents ranged from 1.8 in patients with active duodenal ulcers to 3.0 in those with gastric ulcers; the mean phenol red recovery ranged from 87% in normal subjects to 95% in gastric ulcer patients. The results indicate that the acid secretory effect of mechanical stimulation of the antrum is qualitatively different in healthy subjects and ulcer patients, with a marked acid response in patients with an active duodenal ulcer.

6767 INFLUENCE OF ANTRECTOMY ON GASTRIN RELEASE AND GASTRIC SECRETION IN CONSCIOUS MONKEYS. *(E.)* Rosato, E. F.; Shumate, G. R.; Pollock, T. W.; Adair, L.; Rosato, F. E.; Brooks, F. P. (Philadelphia Veterans Admin. Hosp., Pa. 19104). *Surgery* 77(6): 817-824, 1975.

The plasma gastrin response to feeding and insulin stimulation was determined before and after precise antrectomy in conscious male rhesus monkeys (*Macaca mulatta*). The animals were prepared with gastric fistulas with modified Thomas cannulas. Chlorpheniramine maleate (10 mg) was injected s.c. 15 min before each experiment and histamine acid phosphate (0.02, 0.04, 0.08 mg/kg/hr) in saline was infused i.v. at a constant rate of 30 ml/hr. In the feeding stimulation trials, the animals were given a 30-min standard meal and the plasma gastrin levels were determined in the basal period and 10-180 min after feeding. In the insulin stimulation trials, gastric acid output and plasma gastrin were determined before and for eight 15-min periods after the i.v. injection of aqueous insulin (1-1.5 U/kg). Feeding resulted in a significant increase in plasma gastrin levels from basal levels of 107 pg/ml to 276 pg/ml. Stimulation with insulin increased the plasma gastrin levels to 182 pg/ml from a basal level of 93 pg/ml. Antrectomy reduced the basal gastrin concentrations and abolished the gastrin response to both feeding and insulin. It also abolished the acid secretory response to histamine and insulin. When three monkeys were antrectomized and maintained by duodenal feeding, the histamine acid secretory response was virtually abolished within 24 hr and did not recover within a four week period. In two animals, the addition of a submaximal dose of pentagastrin did not alter the response to histamine stimulation. Parietal cell architecture remained intact. The data indicate that the loss of secretory capacity secondary to antrectomy is due to the loss of circulating antral gastrin. The onset is prompt, is not related to reflux gastritis or parietal cell atrophy, and is not corrected by the administration of pentagastrin. The mechanism of this reaction is unknown.

6768 HEIDENHAIN POUCH DISTENSION AS A STIMULUS FOR ACID AND PEPSIN SECRETION. *(E.)* Magee, D. F.; Hu, C. (Creighton Univ. Sch. Medicine, 2500 Calif. St., Omaha, Neb. 68178). *Ann. Surg.* 182(2):121-123, 1975.

The effects of Heidenhain pouch distension on the secretion of acid and pepsin were studied in six dogs with long-standing Heidenhain pouches and simple gastric fistulas. The pouches were distended with saline (30, 60 and 90 ml), the mean pressures within the pouch being elevated to 16.8, 21.0, and 22.5 cm of $H_2O$, resp. Beginning 30 min before the first distension, pentagastrin was given by continuous i.v. infusion (0.5 µg/min). Atropine sulfate (1 mg, i.v.) and pentolinium tartrate (1 mg/kg, i.m.) were given as single injections, and in some experiments a 0.5% solution of oxethazaine, a topical local anesthetic, was retained in the pouch for 10 min. There was a positive straight-line relation between the volume of saline added to the pouch and acid and pepsin secretion. I.v. pentagastrin did not alter the slope of the acid curve, but greatly increased the yield of acid at each level; pentagastrin had the opposite effect on pepsin secretion. Atropine significantly depressed the arithmetic regression lines for both acid and pepsin, but the calculated secretions at 0 distension were similar with and without atropine. Ganglionic blockade with pentolinium tartrate and

oxethazaine rinse both depressed the acid response significantly, but neither had any effect on pepsin secretion. The data suggest that distension stimulates acid secretion from Heidenhain pouches *via* a cholinergic mechanism involving a local anesthetic-sensitive receptor and a synapse; the mechanism of distension-induced pepsin secretion appears to be different.

6769 INHIBITION OF GASTRIN-STIMULATED CANINE ACID SECRETION BY SHAM-FEEDING. *(E.)* Sjodin, L. (Dep. Pharmacology, Karolinska Institutet, S-104 01 Stockholm, Sweden). *Gut* 15(11):73-80, 1974.

The inhibition of gastric secretion induced by sham feeding was characterized in five mongrel dogs with Heidenhain pouches and esophageal fistulas. Saline was continuously infused for one hr, after which pentagastrin (4 µg/kg/hr), histamine (100 µg/kg/hr), and/or bethanechol chloride (50 µg/kg/hr) was added to the infusion, which was continued for another four hr. After two hr of secretagogue administration, the dogs were sham fed for 10 or 60 min. The gastric juice was collected throughout the infusions *via* a cannula placed in the lower fundic portion of the main stomach. Pentagastrin-stimulated acid output from the vagally innervated main stomach increased significantly after 10 min of sham feeding, while acid secretion from the vagally denervated fundic pouches was depressed by an average of 33% after sham feeding. There was a corresponding reduction in the secretory volume. In the presence of histamine stimulation, sham feeding did not significantly affect the Heidenhain pouch secretion. When secretion was stimulated with a combination of pentagastrin and bethanechol chloride, the inhibitory effect of sham feeding was less pronounced than with pentagastrin alone. After these initial experiments, extra-gastric abdominal vagotomies were performed on four dogs and truncal vagotomies on three. The Heidenhain pouch acid responses to gastrin were decreased in most dogs after selective extra-gastric vagotomy, whereas the inhibitory effect of sham feeding was reduced or abolished by truncal vagotomy. The results are consistent with the hypothesis that vagal activity releases a hormone which has an inhibitory action on gastric acid secretion.

6770 STAGES IN THE RECOVERY OF FEEDING FOLLOWING VAGOTOMY IN RABBITS. *(E.)* Rezek, M.; Vanderweele, D. A.; Novin, D. (Dept. Psychology, Univ. California, Los Angeles). *Behav. Biol.* 14(1):75-84, 1975.

The effects of vagotomy on the spontaneous intake of liquid and solid food was studied in 27 adult female rabbits. The animals were either chronically vagotomized or laparotomized (controls) and maintained on a free-feeding regimen. In the first experiment, the rabbits received duodenal cannulas and were fed a choice of greens, liquid, rabbit pellets during recovery from surgery. Food intake patterns were recorded before surgery and after the daily food intake had stabilized at 100 g or more per day. In the second experiment, the animals were treated as in the first experiment but did not receive duodenal cannulation and received solid and liquid food alternately, not simultaneously. Food intake patterns were recorded as soon as the animal began eating 800 g of solid food or 240 ml of liquid food per day, whether or not intake was stabilized. In the first experiment, the vagotomized animals took significantly longer to recover than the controls and mortality was 25% compared with 0% in the control group. After vagotomy, the animals were aphagic or severely hypophagic when offered only solid food, although they began to eat greens almost immediately. If greens were withdrawn, the animals again became aphagic or hypophagic, after which they spontaneously resumed liquid food intake; stable intake of solid food was not observed until several days later. Once recovered, the vagotomized rabbits showed a pattern of food intake characterized by significantly longer but less frequent meals than observed in the controls; the total daily food intake and feeding time were comparable in the two groups. The circadian pattern of alimentary behavior was largely unchanged after vagotomy. In the second experiment, the vagotomized rabbits showed a pattern of significantly more frequent and significantly smaller meals compared with controls and their own presurgery pattern. In both experiments, the animals shifted after several weeks to a pattern of longer, larger, and less frequent meals. The data indicate that the vagus nerve participates in meal patterning and appetite and that the effects of vagotomy change with time, probably as a result of reorganization of regulative controls. The data also indicate the importance of vagal afferent and efferent information in the control of eating.

6771 EFFECT OF INDUCED HYPERCALCEMIA ON GASTRIN RELEASE BY FOOD AND BY ANTRAL ALKALINIZATION IN MAN. *(E.)* Basso, N.; Giri, S.; Fiocca, F.; Passaro, E., Jr.; Speranza, V. (Instituto Anatomia Chirurgica e Corso Operazioni, Univ. Roma, Italy). *Surg. Italy* 4(2):73-75, 1975.

The effects of induced hypercalcemia on gastrin release stimulated by food and antral alkalinization were studied in six healthy young men. Serum gastrin levels were determined under basal conditions and at 15-min intervals five hr following the ingestion of 150 cc of a saturated sodium bicarbonate solution (pH 7.5); after five days, this protocol was repeated with a three-hr $Ca^{++}$ infusion (4 mg/kg/hr) preceding antral alkalinization and continuing throughout the experiment. In the second experiment, the fasted subjects were allowed to smell cooking food for 15 min and then were fed 250 ml of meat broth and 200 g of lean veal steak; five days later, this protocol was repeated during $Ca^{++}$ administration as in the first experiment. After antral alkalinization, serum gastrin levels rose to 135% of basal values. The protein meal augmented the serum gastrin levels by 25% over basal values, while smelling cooking food decreased the gastrin levels to 85% of basal values. Calcium infusion alone increased basal gastrin levels by 25% during calcium infusion; antral alkalinization and the protein meal augmented basal gastrin levels by 110% and 120%, resp. Smelling cooking food also significantly increased serum gastrin levels in hypercalcemic subjects. The data suggest that calcium

may be a mediator in all of the secretory mechanisms studied.

6772 EFFECTS OF NUTRITIONAL STATUS ON GASTRIC SECRETION AND COMPOSITION IN X-IRRADIATED RAT. *(E.)* D'Souza, D. W.; Vakil, U. K.; Sreenivasan, A. (Biochemistry Food Technology Div., Bhabha Atomic Res. Centre, Bombay, India). *Environ. Physiol. Biochem.* 4(6):270-279, 1974.

The effects of sublethal (400 r) and lethal (800 r) whole-body x-irradiation on the secretion and composition of gastric juice were studied in male Wistar rats maintained on diets with different protein levels (no protein, 8%, or 20%) with or without vitamin A supplementation (5000 IU retinyl palmitate/kg). Morphological changes in the stomachs of irradiated rats were also followed. In rats fed a nutritionally adequate diet, whole-body x-irradiation caused a progressive reduction in gastric acid secretion, with a maximum drop (50% in lethally irradiated rats) on the eighth day; free acidity and total acidity also decreased significantly. Specific peptic activity in gastric juice was 40% and 60% of control values in rats irradiated at 400 r and 800 r, resp.; pepsin and gastricsin activities also declined progressively up to the eight day post-irradiation. In sublethally irradiated rats, gastric juice secretion and proteolytic activities, resp., returned to normal levels on days 14 and 16 postirradiation; lethally irradiated rats did not survive beyond eight to 10 days. Radiation also resulted in a sudden rise (day one) in histamine levels in gastric juice, serum, and tissues, but values returned to normal by day three. While gross and severe degenerations were evident in the rat stomach two days postirradiation (400 r), stomach morphology was normal after eight days. Simultaneous deficiencies in protein and vitamin A had additive effects on gastric secretion and composition. Recovery from radiation injury dependend on the nutritional status of the animal. Protein-fasted animals did not survive beyond 14 days even when exposed to 400 r, and recovery was delayed at least six days in animals fed a low (8%) protein diet. The poor recovery in protein deficiency may be due to higher initial damage and subsequent increased sensitivity of tissues to x-irradiation.

6773 DEPRESSION OF ANTRAL AND SERUM GASTRIN CONCENTRATION BY FOOD DEPRIVATION IN THE RAT. *(E.)* Lichtenberger, L. M.; Lechago, J.; Johnson, L. R. (Veterans Admin. Wadsworth Hosp. Center, Wilshire and Sawtelle Blvd., Los Angeles, Calif. 90073). *Gastroenterology* 68(6):1473-1479, 1975.

The effects of food deprivation and refeeding on serum gastrin concentration and antral G-cell number were studied in male Wistar rats. In the first study, the rats were fed or fasted two, four or six days. In the second study, the rats were fasted for four days then refed for 30 min, three hr, 12 hr, one day, three days, six days, or nine days. In the third study, the rats were starved or fed (six days) powdered rat chow, a liquid diet, a high bulk nonnutritive diet, or a high bulk diet to which sucrose was added. At the completion of each study, serum and antral gastrin concentrations were determined by radioimmunoassay, and antral sections were examined by an indirect immunofluorescent antibody technique. A marked stepwise decrease in antral and serum gastrin levels was noted with increasing periods of starvation; by the fourth day, the antral gastrin decreased to one-third and the serum gastrin decreased to one-eighth of the fed levels. The number of antral cells reacting with fluorescent antigastrin antiserum was correspondingly decreased. After refeeding, the serum gastrin levels returned to normal levels within six days and the antral gastrin concentration and number of G-cells returned to normal within nine days. The rats fed the powdered rat chow or liquid diet for six days showed normal weight gain or maintenance and normal serum and antral gastrin levels. The fasted rats and those fed the high bulk nonnutritive diet lost weight to the same extent and showed similarly reduced antral and serum gastrin levels. Gastrin levels in the rats fed the sweetened high bulk diet were similar to those in the fasted rats. The data suggest that food in the gastrointestinal tract is necessary for the maintenance of normal serum and antral gastrin levels in rat. The effect of food is most likely attributable to its chemical constituents and not distention by bulk.

6774 GASTRIC INTRINSIC FACTOR SECRETION. *(E.)* Vatn, M. H. (Ulleval Hosp., Oslo, Norway). *Scand. J. Gastroenterol.* 10(4):337-338, 1975.

6775 THE ACTION OF SEROTONIN, LISURIDE AND RESERPINE UPON STOMACH EVACUATION IN RATS. *(Z.)* Visnovsky, P. (Fac. Med., Charles Univ., Martin, Czechoslovakia). *Cesk. Gastroenterol. Vyz.* 29(1):18-23, 1975.

6776 THE EFFECT OF GASTRIC ACID SECRETION OF DIFFERENT CHAIN LENGTHS OF FATTY ACIDS IN THE DUODENUM. *(E.)* Deveney, K. E.; Way. L. W. (Dep. Surg., Univ. California, San Francisco, Calif.). *Gastroenterology* 68(4):1009, 1975.

6777 EFFECT OF GIP AND VIP ON GASTRIN RELEASE AND GASTRIC SECRETION. *(E.)* Villar, H. V.; Rayford, P. L.; Reeder, D. D.; Thompson, J. C. (Univ. Texas Med. Branch, Galveston, Tex.). *Gastroenterology* 68(14):1006, 1975.

6778 CELL PROLIFERATION AND MIGRATION IN DEVELOPING GASTRIC MUCOSA. *(E.)* Yeomans, N. D.; Trier, J. S. (Peter Bent Brigham Hosp., Boston, Mass.). *Gastroenterology* 68(4):1002, 1975.

6779 REGULATION OF RAT GASTRIC MUCOSAL GUANYL CYCLASE ACTIVITY (GC). *(E.)* Thompson, M. J.; Jacobson, E. D. (Univ. Texas Med. Sch., Houston, Texas). *Gastroenterology* 68(4):998, 1975.

6780 VISIBLE AND ELECTROPHYSIOLOGICAL EFFECTS OF ETHANOL ON GASTRIC MUCOSA: A TIME STUDY UNDER RESTING, ACID AND SECRETING CONDITIONS. *(E.)* Tague, L. L.; Shanbour, L. L. (Univ. Texas Med. Sch., Houston, Tex.). *Gastroenterology* 68(4):995, 1975.

6781 STUDIES ON ACID-BASE BALANCE IN AMPHIBIAN GASTRIC MUCOSA. *(E.)* Silen, W.; Machen, T. E.; Forte, J. G. (Dep. Physiol-Anat., Univ. California, Berkeley, Calif.). *Gastroenterology* 68(4): 987, 1975.

6782 PREPARATION AND CHARACTERIZATION OF ISOLATED VIABLE MAMMALIAN PARIETAL CELLS. *(E.)* Lewin, M.; Cheret, A. M.; Bonfils, S. (INSERM U. 10, Hosp. Bichat., Paris, France). *Gastroenterology* 68(4):955, 1975.

6783 VARIABILITY OF ACID OUTPUT IN REPEATED GASTRIC ANALYSIS. *(E.)* Meeroff, J. C.; Marchevsky, N.; Meeroff, M. (Univ. Buenos Aires, Buenos Aires, Argentina). *Gastroenterology* 68(4): 953, 1975.

6784 DETERMINANTS OF GASTRIC EMPTYING IN THE DOG. *(E.)* Krejs, G. J.; Sauberli, H.; Largiader, F.; Schmid., P.; Hegglin, J.; Blum, A. L. (Stadtspital Triemli, Zurich, Switzerland). *Gastroenterology* 68(4): 930, 1975.

6785 STIMULATION OF ACID SECRETION BY L- AND D-ISOMERS OF AMINO ACIDS BATHING THE OXYNTIC GLAND AREA. *(E.)* Konturek, S. J.; Tasler, J,; Obtulowicz, W. (Inst. Physiol., Kracow, Poland). *Gastroenterology* 68(4):928, 1975.

6786 CARBONIC ANHYDRASE ACTIVATION IN THE RAT STOMACH RESULTING FROM THE PHOSPHORYLATION OF ITS 3',5'-AMP-DEPENDENT PROTEIN KINASE. *(Rus.)* Bersimbaev, R. I.; Konstantinov, Iu. M.; Argutinskaia, S. V.; Salganik, R. I. (Inst. Cytology Genetics, Sovosibirsk, USSR). *Biokhimiia* 40(3):570-576, 1975.

6787 THE EFFECT OF SINGLE AND REPEATED DOSES OF NICOTINE ON THE GASTRIC MUCOSA OF IMMOBILIZED RATS. *(Ger.)* Schnoy, N.; Droszus, J. U.; Niedobitek, F.; Schmid, E. (Pathologisches Institut, Freie Universitat, Berlin, Germany). *Z. Gastroenterol.* 13(4):445-451, 1975.

6788 GASTRIC SECRETION OF ACID IN HEALTHY CHILDREN. *(Pol.)* Socha, J.; Cichy, W.; Biedrzynska, B. (Zaklad Propedeutyki Pediatrii AM, ul. Szpitalna 27/31, 60-572, Poznan, Poland). *Pediatr. Pol.* 50(5):569-575, 1975.

6789 THE EXPERIMENTAL BASIS OF A NEW METHOD IN THE SURGICAL TREATMENT OF DUODENAL ULCER: THE CHEMICAL SCLEROSIS OF THE GASTRIC MUCOSA. *(Fr.)* Mandache, F.; Ghergut, A.; Stratulat, L.; Popescu, G.; Giuroiu, V.; Pahomeanu, M.; Ciocilteu, P. (No affiliation given). *Chirurgie* 101(2):129-138, 1975.

6790 STUDIES ON DUODENAL REGULATION OF GASTRIC SECRETION. *(Jpn.)* Yunoki, K.; Ichiki, T.; Matsumoto, M.; Morita, N.; Nakao, Y.; Miyahara, K.; Futagawa, T.; Chung, J.; Arima, K. (Inst. Cancer Research, Kagoshima Univ., Japan). *Igaku Kenkyu* 44(2):56-68, 1974.

6791 SIGNIFICANCE OF THE STOMACH ANTRAL PORTION FOR THE CONTROL OF ITS SECRETORY ACTIVITY. *(Rus.)* Pavlova, N. S. (Pavlov's Inst. Physiology, Acad. Sci. USSR, Leningrad, USSR). *Fiziol. Zh. SSSR im. I.M. Sechenova* 61(3):428-432, 1975.

6792 ON HYDROLYSIS OF FOOD PROTEIN IN THE STOMACH. *(Rus.)* Korotko, G. F.; Chalakov, A. K.; Sukhoterin, V. G.; Saidbaeva, L. M.; Apraksin, V. P. (State Medical Inst., Andizhan, USSR). *Fiziol. Zh. SSSR im. I.M. Sechenova* 61(3):415-422, 1975.

6793 BEHAVIOR OF MICROFLORA IN THE RAT STOMACH: ADHESION OF Lactobacilli TO THE KERATINIZED EPITHELIAL CELLS OF THE RAT STOMACH IN VITRO. *(E.)* Suegara, N.; Morotomi, M.; Watanabe, T.; Kawai, Y.; Mutai, M. (Yakult Inst. for Microbiological Res., 1796, Yaho, Kunitachi, Tokyo, Japan). *Infect. Immun.* 12(1):173-179, 1975.

6794 VARIATIONS IN SERUM GASTRIN CONCENTRATION AFTER FEEDING IN MAN, DOG, AND PIG. *(E.)* Brandsborg, O.; Brandsborg, M.; Rokkjaer, M.; Bone, J.; Lovgreen, N. A.; Amdrup, E. (Kommunehospitalet, Arhus Univ., Arhus, Denmark). *J. Surg. Res.* 10(1): 1-4, 1975.

6795 THE EFFECT OF CARBACHOL AND PENTAGASTRIN ON THE GASTRIC SECRETION OF ACID, PEPSIN, AND INTRINSIC FACTOR (IF) IN MAN. *(E.)* Vatn, M. H.; Schrumpf, E.; Myren, J. (Ulleval Univ. Hosp., Oslo 1, Norway). *Gut* 15(11):55-58, 1974.

6796 SECRETIN SNUFF: EVALUATION OF THE ACTION ON PENTAGASTRIN-STIMULATED GASTRIC ACID SECRETION AND ON PANCREATIC BICARBONATE PRODUCTION. *(E.)* Halter, F.; Witzel, L.; Kohler, B.; Hadorn, B. (Univ. Berne, Inselspital Berne, Switzerland). *Gut* 15(11):81-85, 1974.

6797 EFFECT OF SEVERE ANOXIA AND SODIUM TAUROCHOLATE ON $H^+$ LOSS FROM LUMINAL SURFACE OF IN VITRO GASTRIC MUCOSA. *(E.)* Birkett, D.; Silen, W. (Beth Israel Hosp., Boston, Mass.). *Surg. Forum* 24:421-424, 1973.

6798 ROLE OF GASTRIN IN SHORT-BOWEL GASTRIC HYPERSECRETION. *(E.)* Wickbom, G.; McGuigan, J. E.; Landor, J. H. (Coll. Medicine, Univ. Florida, Gainesville, Fla.). *Surg. Forum* 24:353-354, 1973.

6799 EFFECT OF VAGOTOMY ON GASTRIN CONTENT OF GASTRIC FUNDUS AND ANTRUM AND PANCREAS IN RATS. *(E.)* Becker, H. D.; Reeder, D. D.; Thompson, J. C. (Univ. Texas Medical Branch, Galveston, Tex.). *Surg. Forum* 24:359-360, 1973.

6800 THE STABILITY OF HUMAN PEPSINS IN STORED GASTRIC JUICE. *(E.)* Whitecross, D. P.; Piper, D. W. (Royal North Shore Hosp., Sydney, St. Leonards, Australia). *Scand. J. Gastroenterol.* 10(4):395-399, 1975.

See also, 6600, 6602, 6615, 6959, 6968, 6971, 6980, 6982, 6999, 7136, 7148, 7159, 7251, 7289, 7291, 7295.

## SECRETION AND METABOLISM

### Pancreas

6801 IDENTIFICATION OF ENZYMES IN HUMAN PANCREATIC JUICE. *(Fr.)* De Caro, A.; Guy, O.; Crotte, C.; Figarella, C. (Unite de Recherche de Pathologie Digestive, U-31 INSERM, 46 chemin de la Gaye, F 13009 Marseille, France). *Arch. Fr. Mal. App. Dig.* 64(2):115-123, 1975.

Using fibroscopic techniques, human pancreatic juice was extracted by draining the duct of Wirsung from subjects not suffering from pancreatitis. The aim was to study human pancreatic enzymes and zymogens having been separated by polyacrylamide gel electrophoresis at pH 5.0 in a homogeneous system. A competitive inhibitor with trypsin was added to make clear the number of pancreatic zymogens in pancreatic juice with the artifacts of zymogen activation products. Pancreatic bands were identified by immunological techniques or by comparison with the electrophoretic migration of purified proteins. Two immunologically distinct chymotripsinogens, two immunologically identical proelastases, two trypsinogens, one procarboxypeptidase A, one procarboxypeptidase B, one nonspecific esterase, one prophospholipase, three isoamylases, and two isolipases (the latter two being glycoproteins) were reported. The main value of this work is the establishment in one operation of the semi-totality of human pancreatic juices enzymatic content, to enable rapid comparisons among individuals.

6802 CIRCULATORY TURNOVER OF PANCREATIC AMYLASE. *(E.)* Ryan, J.; Appert, H. (Hahnemann Medical Coll. and Hosp., Philadelphia, Pa. 19102). *Proc. Soc. Exp. Biol. Med.* 149(4):921-925, 1975.

The plasma disappearance of i.v. infused radio-iodinated amylase and unlabeled porcine pancreatic amylase in pigs was examined. Radiolabeled ($^{125}I$) amylase and unlabeled pancreatic amylase were infused into 18 adult pigs of both sexes in order to determine the plasma half-life of the enzyme. Regardless of the parameter measured (radioactivity, enzyme activity, or concentration), the plasma removal curves could be resolved into three components when subjected to tracer analysis. The plasma half-life was estimated to be approximately three hr. Through the use of a recently developed radioimmunoassay specific for porcine amylase, the plasma concentration of amylase was calculated at 2.4 µg/ml. Based on the plasma concentration and half-life of amylase, the circulatory turnover of the enzyme was determined. Over a 2.4-hr period, 9.6 µg of pancreatic amylase/ml of plasma must reenter the circulation to maintain the enzyme at constant levels.

6803 BINDING OF BILE SALTS TO PANCREATIC COLIPASE AND LIPASE. *(E.)* Borgstrom, B.; Donner, J. (Dept. Physiological Chemistry, Univ. Lund, Sweden). *J. Lipid Res.* 16(4):287-292, 1975.

Equilibrium dialysis and gel filtration were used to study the interaction between colipase and bile salts in solution. Lipase and colipase were purified from porcine pancreas. The binding of taurodeoxycholate, glycodeoxycholate and taurocholate to colipase at 25 C in 150 mM of NaCl, 1 mM of $CaCl_2$ and 2 mM of Tris-HCl, pH 7.0, was measured by equilibrium dialysis. No binding took place below the critical micellar concentration for the bile salts. Above this concentration, the binding increased sharply for the dihydroxy conjugates, reaching values of 12 to 15 M/M of colipase. The binding of sodium dodecyl sulfate to colipase was found to be similar to that for bile salt and colipase; there was no binding below the concentration below the critical micellar concentration and there was a rapid increase above that point, reaching extrapolated figures of 40 to 50 M/M of colipase. A Sephadex G-100 column was equilibrated with a solution of 4 mM in $^{35}S$-labeled taurodeoxycholate, 150 mM in NaCl, 1 mM in $CaCl_2$ and 2 mM in Tris-maleate, pH 7.0. Colipase (450 nM) dissolved in 0.5 ml of this solution was applied to the column. There was no apparent binding at low and high ligand concentrations. These results indicate that at physiological ionic strength and pH, conjugated bile salts bind micelles to colipase; 12 to 15 M/M of colipase for the dihydroxy conjugates and 2 to 4 for the trihydroxy conjugates. No binding of bile salts took place from monomeric solutions. Under the same experimental conditions, only 1 to 2 M of conjugated dihydroxy bile salts bound to pancreatic lipase. It is concluded that colipase may serve as a nucleus for micellization.

6804 THE INFLUENCE OF DETERGENTS AND TRYPSIN ON THE STIMULATION OF AMYLASE SECRETION BY EITHER PANCREOZYMIN OR SODIUM FLUORIDE IN THE PERFUSED RAT PANCREAS. *(Eng.)* Robberecht, P.; Deschodt-Lanckman, M.; Camus, J.; Cristophe, J. (Univ. Brussels Medical Sch., B-1000 Brussels, Belgium). *Biochem. Pharmacol.* 24(17):1623-1629, 1975.

The effects of detergent and trypsin on the time course of pancreatic amylase secretion and on the stimulation of secretion by pancreozymin and sodium fluoride were studied *in vitro* using pancreatic tissue from male Wistar rats. Pancreas fragments were perfused for 2 hr with Krebs-Ringer bicarbonate buffer containing 10 mM of glucose and Trasylol (500 UIK/ml). In some experiments, digitonin, sodium dodecylsulfate, Triton X-100 or bovine trypsin (0.010, 0.025 or 0.050%) were added to the incubation medium for 30 min, after which the tissues were perfused with normal Krebs-Ringer-glucose medium for 30 min. Pancreozymin (320 U/ml) or NaF (10 mM) was added after this second 30-min period. α-Amylase in the perfusion medium and in the tissue fragments was estimated at 5-min intervals by the saccharogenic technique. In the absence of any of the added agents, the basal output of amylase decreased rapidly during the first 10 min, thereafter remaining stable at about 0.4% of the initial tissue content/5 min. The basal output increased with increasing concentrations of digitonin and sodium dodecylsulfate and with high concentrations of Triton X-100, but not with added trypsin. In the absence of any of these four agents, pancreozymin ($7 \times 10^{-9}$ M) rapidly stimulated amylase output, a two-fold increase over basal levels being attained within 20 min and thereafter remaining stable. This stimulation decreased progressively and finally disappeared after pretreatment with increasing concentrations of the three detergents or trypsin. NaF caused a biphasic stimulation of amylase secretion; the rapid initial peak was unspecific and related only to the NaF-induced rise in osmolarity, while the second, prolonged wave was due to NaF itself. Preexposure to detergent or to trypsin had no effect on the initial peak but caused a decrease in the second peak. However, sodium dodecylsulfate and digitonin in concentrations which abolished the secretory response to pancreozymin merely inhibited the second secretory effect due to NaF; Triton X-100 and trypsin were equally effective in abolishing the secretory responses to pancreozymin and NaF. The data suggest that the *in vitro* regulation of secretion by pancreozymin and NaF in intact acinar cells of the rat pancreas involves two distinct loci of a membrane-lipoprotein complex.

6805 PANCREATIC SECRETION OF TOTAL PROTEIN AND OF THREE HYDROLASES COLLECTED IN HEALTHY SUBJECTS VIA DUODENOSCOPIC CANNULATION. *(E.)* Robberecht, P.; Cremer, M.; Vandermeers, A.; Vandermeers-Piret, M. C.; Cotton, P.; De Neef, P.; Christophe, J. (Univ. Brussels Medical Sch., Waterloo Blvd. 115, B-1000 Brussels, Belgium). *Gastroenterology* 69(2): 374-379, 1975.

The effects of secretin (1 Crick-Harper-Raper [CHR] U/kg), pancreozymin (CCK-PZ) (1 CHR U/kg), and cerulein (20 μg/kg) on the pancreatic secretion of total protein, amylase, lipase, and chymotrypsinogen were studied in 10 fasted male and female subjects free of gastrointestinal disease. The main pancreatic duct was cannulated to a depth of 2-3 cm, *N*-butylscopalammonium bromide being used to suppress duodenal peristalsis. The pancreatic juice was collected at 1-min intervals for up to 30 min; secretin injected i.v. at time zero and CCK-PZ or cerulein was injected 10-20 min later. Rapid i.v. secretin produced an immediate stimulation of protein and amylase secretion of 2-4 min duration and a sustained rise in flow rates. CCK-PZ produced a prompt 5- to 10-fold rise in the concentration and output of amylase and protein, the effect on volume secretion being relatively small compared with that on enzyme and protein secretion. The half-life of the CCK-PZ effect was 70-100 sec. Cerulein also stimulated the pancreatic secretion of protein and amylase; the pattern, magnitude, and duration of the response were the same as that produced by CCK-PZ. In addition, cerulein significantly stimulated the secretion of lipase and chymotrypsinogen. After stimulation of secretion, there was no significant change in the specific activity of chymotrypsinogen or in the ratios of the enzyme activities. The half-life of the effect of CCK-PZ and cerulein on pancreatic secretion was independent of flow rate and maximum protein output. The results are at variance with those previously reported in the cat and rabbit.

6806 GLUCAGON RELEASE: PARADOXICAL STIMULATION BY GLUCOSE DURING CALCIUM DEPRIVATION. *(E.)* Leclercq-Meyer, V.; Rebolledo, O.; Marchand, J.; Malaisee, W. J. (Lab. Experimental Medicine, Univ. Brussels, 1000 Brussels, Belgium). *Science* 189(4206):897-899, 1975.

The paradoxical stimulation of glucagon release by glucose during calcium deprivation was studied in unfasted female albino rats. The pancreases of these animals were perfused *in situ* with Krebs-Ringer bicarbonate buffer containing bovine albumin (4 g/100 ml), glucose (3.3-16.6 mM, during the first 80 min), and calcium (2 mM, during the first 40 min). The effluent was assayed for glucagon and insulin by radioimmunoassay. Glucose (8.3 or 16.6 mM) stimulated insulin release during calcium administration but not during calcium deprivation. The output of glucagon during calcium administration was inversely related to the glucose concentration in the perfusion medium, calcium deprivation consistently provoking an enhancement of glucagon secretion. The effect of calcium deprivation was reversible. The positive secretory response of the pancreatic alpha cell to calcium deprivation consisted of two components: the first was characterized by an immediate, sharp, and short-lasting (about 4 min) peak of secretion which was most evident at the lowest glucose concentration; and the second, or late secretory phase, was absent at the lowest glucose concentration but was characterized by a long-lasting stimulation of glucagon release at higher glucose levels. It is suggested that the paradoxical stimulation of glucose during calcium deprivation, which is reminiscent of the abnormality of glucagon secretion observed in dia-

betes mellitus, results from a perturbation in the normal structural and functional bridging between pancreatic alpha and beta cells.

6807 COMPARISON OF SECRETIN AND VASOACTIVE INTESTINAL PEPTIDE ON PANCREATIC SECRETION IN DOGS. *(E.)* Konturek, S. J.; Thor, P.; Dembinski, A.; Krol, R. (Medical Acad., Krakow, ul. Grzegorzecka 16, Poland). *Gastroenterology* 68(6):1527-1535, 1975.

The action of the vasoactive inhibitory peptide (VIP) on pancreatic secretion under basal conditions and in response to secretin or cholecystokinin was studied in chronic pancreatic fistula mongrel dogs (three). Dogs were also provided with gastric fistulas. Graded i.v. doses of VIP and secretin produced a dose-related secretory response at 8 μg/kg/hr and 4 U/kg/hr, resp. The maximal bicarbonate response to VIP (0.75 mEq/30 min) was about 17% of that to secretin. Both cerulein (100 ng/kg/hr) and endogenous cholecystokinin released by a peptone meal potentiated pancreatic bicarbonate response similarly to secretin. From the dose-response curves to secretin alone and secretin plus VIP, Michaelis-Menten analysis showed competitive inhibition. Maximal inhibition occurred with 8 μg of VIP. These data indicate that VIP is a potent inhibitor of secretin-induced pancreatic secretion, and suggest that VIP and secretin share a common receptor site.

6808 SOMATOSTATIN SUPPRESSES SECRETIN AND PANCREATIC EXOCRINE SECRETION. *(Eng.)* Boden, G.; Sivitz, M. C.; Owen, O. E.; Essa-Koumar, N.; Landor, J. H. (Temple Univ. Health Sci. Center, Philadelphia, Pa. 19140). *Science* 190(4210):163-165, 1975.

The effects of somatostatin on the release of immunoreactive secretin (IRS) from the proximal small intestine and the pancreatic secretion of water, bicarbonate and protein were studied in conscious fasted dogs with long-term pancreatic fistulas. Synthetic somatostatin (200 μg, in the cyclic form) infused continuously for 30 min into a hind leg vein had no significant effect on IRS concentrations, but it significantly depressed pancreatic flow and the secretion of bicarbonate and secretin. In contrast, when somatostatin (200 μg/30 min) was infused concurrently with HCl (9.6 mEg/30 min, intraduodenally), the significant rise in IRS concentrations produced by HCl alone was completely abolished. The HCl-stimulated pancreatic flow rate and bicarbonate and protein secretion were also suppressed 67%, 72% and 64%, resp., by somatostatin. The inhibitory effects of somatostatin on IRS release and exocrine pancreatic secretion were short-lived and completely reversible. The data suggest that somatostatin may have a physiologic role in the secretion of pituitary, pancreatic, gastric, and duodenal hormones.

6809 INHIBITION OF PANCREATIC EXOCRINE SECRETION BY VINBLASTINE. *(E.)* Nevalainen, T. J.; (Dept. Pathological Anatomy, Univ. Turku, Finland). *Res. Exp. Med. (Berl)* 165(2):163-168, 1975.

The role of microtubules in pancreatic enzyme secretion was studied using the microtubule active agent vinblastine. Inbred BALB/c mice were given vinblastine sulfate and/or pilocarpine hydrochloride (20mg/kg) i.p., and amylase activity was determined in pancreatic homogenates. Vinblastine sulfate (200 mg/kg) given i.p. did not alter the pancreatic amylase content under the conditions of the experiment. Pilocarpine significantly decreased pancreatic amylase content within 2 hr. Pretreatment with vinblastine abolished this stimulatory effect of pilocarpine in a dose-dependent fashion at doses of 4, 40, and 400 mg/kg. These results are not unequivical proof of microtubule involvement in the secretory mechanisms in pancreatic acinar cells. Other effects of vinblastine must be considered, such as disturbances of amino acid metabolism, anticholenergic actions, and possible cell damage. The role of microtubules in the secretory mechanism of pancreatic acinar cells awaits further clarification.

6810 ENZYME SECRETION IN THE ABSENCE OF ZYMOGEN GRANULES. *(E.)* Rothman, S. S. (Dept. Physiology, Univ. California, San Francisco, Calif. 94143). *Am. J. Physiol.* 228(6):1828-1834, 1975.

The secretion of digestive enzymes was compared to the number of zymogen granules within the acinar cells in fasted and anesthetized adult male Holtzman rats. Pure pancreatic juice was collected from the cannulated common bile duct. Digestive enzyme secretion was studied before and after progressive degranulation of acinar cells produced by three s.c. doses of 0.8 mg/kg of methacholine chloride (a cholinergic stimulator). The kinetics of degranulation was estimated from the relative cell volume occupied by electron-opaque granules at various times using a random point-count stereological technique to examine tissue sections. Electron microscopic examinations showed that the three injections produced the almost complete disappearance of electron-opaque granules from secretory cells. Greatly augmented enzyme secretion was still observed: 10-fold greater for protein output overall; 7-fold greater for trypsinogen; and 25-fold greater for chymotrypsinogen. It is suggested that the movement of enzyme across the cell membrane into the duct system is from the cytoplasm, and that such movement is a final common step in the secretion of digestive enzyme derived from a variety of intracellular pools. However, the quantitative importance of the proposed transport mechanism in the normal process of protein secretion has yet to be determined.

6811 STUDIES ON HYPOXIA. X. EFFECTS OF SYNTHETIC POLYRIBONUCLEOTIDES ON PANCREAS FROM HYPOXIC AND CONTROL RATS: AN ELECTRON MICROSCOPIC AND BIOCHEMICAL STUDY. *(E.)* Kim, Y. G.; Han, S. S. (Univ. Michigan Sch. Medicine, Ann Arbor, Mich. 48104). *Exp. Mol. Pathol.* 23(1):43-58, 1975.

The effect of a mixture of synthetic polyadenylic and polyuridylic acids (poly A:U) on the structure and function of pancreatic acinar cells after prolonged hypoxia was studied. Sprague-Dawley rats were placed in a chamber with 12% $O_2$ and 88% $N_2$ for

seven days. A homopolymer of poly (A:U) was injected i.p. at 1 mg/kg 24 hr before sacrifice. Pancreatic tissue was fixed with paraformaldehyde and $OsO_4$ for electron microscopy and stained with toluidine blue for light microscopy (nucleolar index was calculated from the number of nucleoli/number of nuclei x 100). For biochemical analysis, tissues were homogenized and counted by liquid scintillation spectrometry. Alpha amylase content was measured to indicate synthetic activity. Light microscopy showed that poly (A:U) treatment had little effect on controls, but in hypoxic rats there were smaller and fewer zymogen granules, the Golgi complex was enlarged, and the number and size of nucleoli was increased. The nucleolar index went from 73 in untreated to 88 in poly (A:U)-treated rats; there was a 21% increase in controls. In contrast, hypoxic rats showed an increase of from 61 in untreated to 85 in treated rats--a 40% increase. Ultrastructurally, poly (A:U)-treated control rats showed extensive development of the Golgi complex with condensing vacuoles of the distal portions of the cisternae increased in number. Treated hypoxic rats were similar. Occasionally, treated control rats had numerous zymogen granules in the rough endoplasmic reticulum cisternae. Biochemical tests showed that the DNA content of both control and hypoxic rats receiving poly (A:U) was 129% and 108%, resp., of those not receiving it. The difference between the hypoxic groups receiving and not receiving poly (A:U) was insignificant. Total protein in µg of protein/µg DNA after treatment was reduced to 68% and 75%, resp., in control and hypoxic groups from those not treated. Amylase content in treated rats was reduced to 89% in control and to 71% in hypoxic rats. Controls treated with poly (A:U) were lower in radioactivity (68%) than those untreated. The acid soluble fraction from treated controls was 63% of those untreated, while that of treated hypoxic rats was 54% of those untreated. Treatment produced an increase in radioactivity (172%) in hypoxic cells. It is concluded that poly (A:U) stimulates the functioning of the Golgi complex in rat acinar cells, consequently increasing protein synthesis, and to a greater extent in hypoxic rats.

6812 THE TRYPSINOGEN AND CHYMOTRYPSINOGEN CONTENTS OF THE PANCREAS DURING ACUTE EXPERIMENTAL PANCREATITIS OF THE RAT. *(E.)* Huttunen, R. (Dep. Anatomy, Univ. Oulu, 90220 Oulu, Finland). *Scand. J. Gastroenterol.* 10(2):177-180, 1975.

The fate of trypsinogen and chymotrypsinogen during inflammation of the pancreas was studied in rats. Long-Evans rats were divided into three groups: 1) controls; 2) rats killed 2 hr after induction of pancreatitis; and 3) rats killed 8 hr after induction. The time needed for maximal proenzyme activation was determined by incubating a mixture of the pancreatic supernatant, enterokinase and the buffer at 37 C. Aliquots were taken at various intervals, and free trypsin and chymotrypsin activities were estimated, using N-α-benzoyl-DL-arginin-4-nitroanilid hydrochloride and succinyl-L-phenylalanine-p-nitroanilide as substrates. Activation of chymotrypsinogen was more rapid than the activation of trypsinogen, with maximal activation occurring in 3 hr, while activation of trypsinogen required 17 hr. The content of both proenzymes decreased significantly during pancreatitis. In 8 hr the decline of trypsinogen content was 28.4% and that of chymotrypsinogen was 44.9% from the proenzyme content of the normal resting rat pancreas. No correlation was found between the trypsinogen and chymotrypsinogen content of the normal pancreas, but they were clearly correlated during pancreatitis. These data indicate that during pancreatitis, proenzymes and/or proteases are freed. It is suggested that the correlation between the proenzyme contents during inflammation reflects the amount of viable pancreatic tissue and the rate of synthesis.

6813 ELECTROPHORESIS AND ISOELECTRIC FOCUSING IN POLYACRYLAMIDE GEL. ADVANCES OF METHODS AND THEORIES, BIOCHEMICAL AND CLINICAL APPLICATIONS. *(Ger.)* Tympner, V. F.; Domschke, S.; Domschke, W.; Demling, L. (Medizinischen Klinik der Poliklinik, Univ. Erlangen-Nurnberg, Germany). *Fortschr. Med.* 93(12):627-630, 1975.

6814 EFFECT OF FUROSEMIDE ON PANCREATIC EXOCRINE FUNCTION. *(E.)* Thomas, F. B.; Falko, J. M.; Caldwell, J. H.; Mekhjian, H. S. (Dep. Med., Ohio State Univ., Columbus, Ohio). *Gastroenterology* 68(4):998, 1975.

6815 MICROPUNCTURE STUDY OF ELECTROLYTE SECRETION IN THE CAT PANCREAS. *(E.)* Reber, H. A.; Lightwood, R.; Zakula, S. (VA Hosp., San Francisco, Calif.). *Gastroenterology* 68(4):972, 1975.

6816 IN VITRO GLUCAGON RELEASE BY VASOACTIVE INTESTINAL PEPTIDE (VIP). *(E.)* Schebalin, M.; Said, S. I. (Med. Coll. Virginia, Richmond, Va.). *Gastroenterology* 68(4):941, 1975.

6817 STUDIES ON THE ORGAN CULTURE OF RAT PANCREAS. I. THE EFFECTS OF TEMPERATURE AND GAS PHASE ON THE MAINTENANCE OF RAT PANCREAS IN ORGAN CULTURE. *(Jpn.)* Ikegami, T. (First Dept. Internal Medicine, Kyushu Univ., Kukuoka, Japan). *Fukuoka Acta Med.* 65(5):249-258, 1974.

6818 REACTION OF THE PANCREAS TO ITS RESECTION IN EXPERIMENTAL ANIMALS. *(Rus.)* Mikhailichenko, V. A. (Donetsk Medical Inst., Donetsk, USSR). *Eksper. Khir. Anesteziol.* (1):40-41, 1975.

6819 EFFECT OF 2,4,6-TRIMETHOXYPHENYL(3-PYRROLIDINO)PROPYL KETONE ON EXOCRINE PANCREATIC AND BILIARY SECRETION IN THE RAT. *(Fr.)* Debray, C.; Vaille, C.; De La Tour, J.; Roze, C.; Souchard, M. (Hosp. Bichat, Paris, France). *Therapie* 30(2):259-266, 1975.

6820 FUNCTIONAL CORRELATIONS IN AUXILIARY PANCREAS TRANSPLANT IN DOGS. EVALUATION TECHNIQUE. *(It.)* Roti, E.; Morosini, S.; Cavazzini, G.; Roncoroni, L.; Vescovi, P. P.; Manfredi, A.; Zola, C.; Foggi, E.; Violi, V.; Gnudi, A.; Peracchia, A. (Istituto di Patologia Speciale Medica, Universita di Parma, 43100 Parma, Italy). *Ateneo Parmense [Acta Biomed.]* 45(4-5):247-255, 1974.

6821 LAPAROSCOPY AND BIOPSY OF THE PANCREAS IN MINIATURE PIGS AND PIGLETS: A NEW WAY FOR INVESTIGATIONS OF THE PANCREAS IN ANIMAL EXPERIMENTS. *(E.)* Klapdor, R.; Humke, R. (I. Med. Klinik, 2000 Hamburg, Germany). *Endoscopy* 6(4):248-250, 1974.

6822 ELECTRON MICROSCOPIC OBSERVATIONS ON CYSTIC FIBROSIS OF THE PANCREAS IN A CAT. *(E.)* Suzuki, Y.; Watari, N. (Dept. Veterinary Anatomy, Gifu Univ., Fifu-ken, Japan). *Nihon Rynsho Denshi Kenbikyo Gakkai-Shi* 7(3-4):344, 1974.

6823 PROLONGATION OF PANCREATIC ALLOGRAFT SURVIVAL BY 5-FLUOROURACIL. *(E.)* Castellanos, J.; Manifacio, G.; Toledo-Pereyra, L.; Lillehei, R. C.; Shatney, C. H. (Univ. Minnesota Health Sciences Center, Minneapolis, Minn.). *Am. J. Surg.* 130:53-56, 1975.

See also, 6610, 6611, 6796, 6799, 6941, 6952, 6974, 7548, 7563, 7574.

## SECRETION AND METABOLISM

### Hepatobiliary Tract

6824 SCANNING ELECTRON MICROSCOPE STUDY OF DISSE SPACES AND CAPILLARIES IN RAT LIVER. *(Fr.)* Motta, P.; Porter, K. R. (Istituto di Anatomia Umana Normale, Universita di Roma, Viale Regina Elena 289, Roma, Italia). *Bull. Assoc. Anat.* 58(162): 631-638, 1974.

Scanning electron microscopy (SEM) was used to study the relation between the capillaries and the hepatic cells in normal adult rats. Five anesthesized rats were injected through the left ventricle with a Tyrod solution containing oxygen and 0.1% procaine and heparin. Thirty seconds later a 2.5% buffered glutaraldehyde solution (0.18M, pH 7.3) was used to fix the organs. After dehydration, temperature of the pieces was lowered to the critical point in liquid $CO_2$. SEM demonstrated that the thin endothelial cells lining the rat sinusoids had a large number of fenestrations varying greatly in size. The presence of Kupffer cells and the existence of double layered endothelial cells could limit speed of filtration. The capillaries of the Disse space were obvious on all hepatic cells cemented to form biliary canals, yet there was never a communication between these canals and the sinusoids. In some places the Disse sinusoids actually became intracellular canaliculi, hence creating a network of interstitial lymph. The result is an increased exchange surface between hepatocytes, endothelial cells and the interstitial lymph.

6825 SCANNING ELECTRON MICROSCOPY DEMONSTRATION OF CILIA IN RAT INTRAHEPATIC BILE DUCTS. *(E.)* Motta, P.; Fumagalli, G. (Dept. Anatomy, Univ. Rome, Italy). *Z. Anat. Entwicklungsgesch.* 145(3): 223-226, 1974.

Scanning electron microscopy was used to study cilia in the rat intrahepatic bile ducts. The lumen of portal and perilobular bile ducts and ductules appeared to be lined with numerous, small microvilli along with irregularly scattered, long cilia. These cilia arose perpendicularly as isolated, thin, cylindrical evaginations of the cell surface. They measured 0.2 μ in thickness and 0.5 μ in length. The surfaces of the cilia were finely granulated with some spherical swellings at the tips and along the surface. The cilia appeared more numerous in the larger portal ducts. It was suggested that these cilia are engaged in continual mixing and propulsion of the bile product or may serve in slowing bile flow, thus promoting its partial reabsorption. The occurrence of similar cilia in pancreatic ducts serves as a basis of speculation as to a common function to both organs.

6826 ASSESSMENT OF LYSOSOME MEMBRANE STABILITY. *(Rus.)* Pokrovskii, A. A.; Tutelian, V. A.; Kravchenko, L. W. (Inst. Nutrition, Moscow, USSR). *Biokhimiia* 40(3):545-551, 1975.

The effects of different concentrations of non-ionic detergents, triton X-100, triton X-305, BRIJ-35 and triton WR-1339, on the general and non-sedimentary activity of eight enzymes in liver lysosomes of male Wistar rats were determined. The enzymes investigated were: acid phosphatase, acidic DNase, acidic RNase, arylsulfatases A and B, glucuronidase, galactosidase, glucosidase, and acetylglucosaminidase. Lysosomal fractions were isolated by differential centrifugation. Subsequently, 5 ml portions of lysosomal suspension were mixed with 0.1 ml portions of 0.05, 0.1, 0.5, 1.0 and 2.0% detergent solutions,

incubated for 15 min at 25C, and centrifuged. The non-sedimentary activity was determined by spectrophotometry. Only triton X-100 (0.1%) caused full release of lysosomal enzymes. The degree of release of acidic DNase, B-galactosidase, B-glucuronidase, and acid phosphatase were considerably higher than of the other enzymes. A method was developed for serial investigation of the stability of lysosomal membranes in animals with various physiological and pathological conditions. The method consisted of treating isolated structures with increasing concentrations of triton X-100 (0.025, 0.05, and 0.01%) with the subsequent determination of non-sedimentary activity marking the enzymes.

6827 DETERMINATION OF THE SPECIFIC BLOOD FLOW OF THE LIVER BY INHALATION OF RADIOACTIVE RARE GASES. *(E.)* Schmitz-Feuerhake, I.; Kuchzermeyer, H.; Reblin, T. (Medizinische Hochschule Hannover, 3 Hannover-Kleefeld, Karl Wiechert Allee 9, West Germany). *Acta Hepato-Gastroenterol.* 22(3):150-158, 1975.

A new technique involving the inhalation of radioactive xenon was used to study the specific blood flow of the liver in human livers of known fat content. The subjects inhaled a mixture of $^{133}Xe$ and air at a concentration of 1 μCi/ml for 2.5 min. Scintillation detectors were arranged over the liver and spleen for the registration of 81 keV-γ-radiation. A double isotope measurement using $^{133}Xe$ parallel to radioactive krypton was employed to determine the dependence of the partition coefficient on the liver fat content. Using the $^{133}Xe$ inhalation technique, an average blood flow of 91 ml/100 g/min was found in people with healthy livers; the reproducibility of the values was 5%. The xenon wash-out was delayed in cirrhotic livers, the blood flow being significantly decreased to an average value of 45 ml/100 g/min. A delayed wash-out of xenon was also found in major fatty livers due to xenon's high affinity for fat. Thus, a retarded wash-out of xenon can mean a reduced blood flow or a major fatty degeneration. The double isotope measurements in patients with known liver fat content showed a good conformity in livers with fat contents less than 10%. In the case of higher fat content, it was not possible to determine the blood flow with satisfactory accuracy due to an inability to accurately determine the partition coefficient. The method should therefore be suitable only for relative measurements.

6828 BIOPHARMACEUTICAL STUDY OF THE HEPATOBILIARY TRANSPORT OF DRUGS. III. BINDING CHARACTERISTICS OF BROMPHENOL BLUE AND AMARANTH TO THE LIVER CYTOPLASMIC Y AND Z BINDING PROTEINS *IN VITRO*. *(E.)* Takada, K.; Narumiya, O.; Muranishi, S. (Faculty Pharmaceutical Sciences, Kyoto Univ., Yoshida-shimoadachi-cho, Sakyo-ku, Kyoto, Japan). *Chem. Pharm. Bull. (Tokyo)* 23(4):729-735, 1975.

The binding properties of the Y and Z binding proteins for two organic anionic compounds (bromphenol blue and amaranth) were investigated by modification of the proteins with sulfhydryl-blocking reagents, amino acid group modifiers, and fluorescent probe. Isolated perfused livers were obtained from male Sprague-Dawley rats. The binding of bromphenol blue appeared to be independent of ionic strength. With greater pH, the binding of this compound with both proteins decreased. Amaranth had a higher affinity for the Y and Z proteins ($5.67 \times 10^4$ and $1.43 \times 10^4$ $M^{-1}$, resp.) than for bovine serum albumin ($1.33 \times 10^4$ $M^{-1}$). There was a reverse result obtained, however for bromphenol blue, which had higher affinities for bovine serum albumin ($6.58 \times 10^5$ $M^{-1}$) than for the Y or Z proteins ($1.29 \times 10^5$ and $1.39 \times 10^5$ $M^{-1}$, resp.). There was no significant inhibition of binding observed by any of the sulfhydryl blocking reagents (*p*-chloromercuribenzoic acid, *p*-chloromercuribenzene sulfonic acid, N-ethylmaleimide, and iodoacetamide) on binding of either amaranth or bromphenol blue to either the Y or Z proteins. The binding of bromphenol blue to either protein was inhibited by the amino group modifiers: succinic anhydride (51.9 and 91.2%); maleic anhydride (96.8 and 84.5%); and acetic anhydride (50.5 and 24.2%), for the Y and Z proteins, resp. The binding of amaranth was not so greatly inhibited. Fluorescent probe showed that the binding of amaranth to the Y protein especially and of bromphenol blue to a lesser extent to both proteins was mainly due to hydrophobic forces. It is concluded that plasma protein-binding does not determine hepatobiliary transport of organic anionic compounds.

6829 Z PROTEIN IN HEPATIC UPTAKE AND ESTERIFICATION OF LONG-CHAIN FATTY ACIDS. *(E.)* Mishkin, S.; Stein, L.; Fleischner, G.; Gatmaitan, Z.; Arias, I. M. (Albert Einstein Coll. Medicine, Bronx, N.Y. 10461). *Am. J. Physiol.* 228(6):1634-1640, 1975.

Hepatic uptake and esterification of fatty acid were measured following administration of flavaspidic acid to determine whether binding of long-chain fatty acids to Z protein is obligatory in these processes. Fatty acid radioactivity was bound to Z protein in liver *in vivo* after administration of [$^3$H]-oleate (20 μCi) to male Sprague-Dawley rats. The same activity was found in isolated perfused rat livers. Oleate radioactivity bound to Z protein was effectively reduced by pretreatment with flavaspidic acid (340 μM/kg) by 90.2% and by 85.0% in intact and perfused livers, resp. However, plasma clearance, hepatic uptake and esterification of [$^3$H]oleate were not altered by pretreatment with flavaspidic acid. Infusion of flavaspidic acid (340 μM/kg) or BSP (360 μM/kg) increased uptake of [$^3$H]oleate at least twofold, and oleate esterification was decreased by 15 to 30% in isolated perfused livers. These results indicate that Z protein may function as an organic ligand-binding protein, and may be important in fatty acid esterification.

6830 COMPARATIVE UPTAKE OF SULFOBROMOPHTHALEIN BY ISOLATED KUPFFER AND PARENCHYMAL CELLS. *(E.)* Stege, T. E.; Loose, L. D.; Di Luzio, N. R. (Tulane Univ. Sch. Med., New Orleans, La.). *Proc. Soc. Exp. Biol. Med.* 149(2):455-461, 1975.

The effects of serum, albumin, and varying concentrations of ethanol on the uptake of sulfobromophthalein (BSP) by hepatic parenchymal and Kupffer cells isolated from male Sprague-Dawley rats were studied. The isolated cells were suspended in bicarbonate-free Hanks' balanced salt solution containing 5, 10, or 20% isologous rat serum, 2.5, 5, or 10% albumin, or 100, 200, or 400 mg of ethanol/100 ml. BSP (10 µg) was then added to the incubation mixture. Cellulose powder thin-layer chromatography was used to determine the cellular concentrations of BSP and its glutathione conjugate (BSP-GSH). The isolated Kupffer cells did not take up BSP from the incubation medium, and did not form BSP-GSH. The parenchymal cells, on the other hand, showed a maximum BSP uptake of 49.8 $\mu g/10^7$ cells after 15 min incubation; after 60 min of incubation, the incubation medium contained no free BSP but did show the presence of BSP-GSH. The rate of and maximum uptake of BSP by the parenchymal cells was inversely related to the concentration of serum or albumin in the incubation medium; the inability of the Kupffer cells to take up BSP from the medium was unaltered by variations in the cell number or in serum concentration. Ethanol had no direct cytotoxic effects and did not alter BSP uptake by the isolated parenchymal cells. The results indicate that the uptake and conjugation of BSP are exclusive functional expressions of the hepatic parenchymal cell population. They also illustrate the potential use of isolated cells as a model system for the rapid and direct assessment of hepatotoxic agents on hepatic cell populations and functions.

6831 SULFATION OF BILE SALTS: A NEW METABOLIC PATHWAY. *(E.)* Stiehl, A. (Medizinische Universitatsklinik, Heidelberg, Federal Republic of Germany). *Digestion* 11(5-6):406-413, 1974.

The metabolism of sulfated bile salts in man and the rat is discussed, as is the effect of sulfation on the toxic properties of bile salts. The sulfation of bile salts renders them polar and more water soluble, thus altering their metabolism, excretion, and toxicity. In human bile, considerable amounts of lithocholate can be sulfated both in health and disease, lithocholate being preferentially sulfated in comparison with other bile salts. The urinary excretion of sulfate esters of bile salts represents an important excretory mechanism in patients with cholestatic liver disease. For the most part, only one or two hydroxyl groups of the bile salts excreted in the urine are sulfated. The sulfate bile salts are excreted in the urine more rapidly than nonsulfated bile salts, a phenomenon which may be partially due to the diminished protein binding and/or decreased tubular reabsorption of the former. Although sulfation of bile salts is only known to occur in the liver, it is possible that sulfation by the kidney might contribute to the large amounts of bile salt sulfates in the urine. It is unlikely that sulfated bile salts are responsible for the pruritus in patients with cholestasis. In the rat, less lithocholate is sulfated than in man, although in the rat as in the human the sulfation of bile salts is an important metabolic pathway in the cholestatic liver. Sulfate esters of lithocholate are more rapidly eliminated in the feces and urine of the rat than are the nonsulfated compounds and it is likely that sulfation of lithocholic acid could enhance its fecal elimination. Most of the sulfated bile salts in the rat are present as taurine or glycine conjugates, the enzymatic hydrolysis of which is slower than with the unsulfated compounds. Sulfated bile salts appear to have considerably less liver toxic properties than the nonsulfated compounds; thus, the sulfation of bile salts becomes important in patients with cholestasis in whom elevated bile salt concentrations can cause liver damage.

6832 INCORPORATION OF ALA-$^{14}$C IN CIRCULATING BILIRUBIN AND HEMOGLOBIN HEME OF HEPATECTOMIZED DOGS. *(E.)* Royer, M.; Sfarcich, D. (Policlinico A. Posadas Haedo, Argentina). *Acta Hepato-Gastroenterol.* 22(3):139-144, 1975.

The formation of bilirubin from nonhemoglobin sources was studied in intact and hepatectomized mongrel dogs. The fasted dogs were hepatectomized or subjected to common bile duct cannulation and injected i.v. with 50 µCi of delta amino-levulinic acid-4-$^{14}$C (ALA-$^{14}$C). Blood samples were obtained at 3-hr intervals for 15 hr from the hepatectomized dogs and blood and bile samples were taken at 14, 45, 105 and 165 min, and at 4, 6 and 9 hr from the intact dogs. The radioactivity of bilirubin and heme in the blood was measured after crystallization. In the hepatectomized animals, the blood bilirubin-$^{14}$C concentration peaked 3 to 6 hr after ALA-$^{14}$C administration, then slowly declined. During this time, the hemoglobin heme radioactivity was much lower and rose sluggishly; the bilirubin specific activity was several hundred times that of the hemoglobin heme and the incorporation of isotope was also much greater for the bilirubin. In the intact dogs, i.v. ALA-$^{14}$C produced similar results, but the amount of bilirubin-$^{14}$C produced in 9 hr in the hepatectomized animals was only about 12% of the total blood bilirubin-$^{14}$C in the intact animals. Nonhemoglobin bile production in the intact dogs was only about 4.2% of the total bile production. The results indicate that bilirubin is produced outside the liver by a mechanism other than the breakdown of hemoglobin.

6833 PRODUCTION OF URIC ACID IN THE HUMAN LIVER DURING PARENTERAL ADMINISTRATION OF FRUCTOSE. *(Ger.)* Grunst, J.; Dietz, G.; Wicklmayr, M.; Motz, S.; Eisenburg, J.; Mehnert, H.; Hepp, K. D. (I. Med. Klinik, Univ. Munchen, Germany). *Vehr. Dtsch. Ges. Inn. Med.* 80:487-491, 1974.

Uric acid concentrations were measured in the hepatic vein and arterial and peripheral venous blood in six normal subjects who had fasted for 15 hr before, during, and after an i.v. infusion of a 10% fructose solution. After a 30 min control period, 10 g of fructose was infused in the first five min and then 0.5 g/kg/hr. Liver blood flow was measured with the $^{135}$Xe inhalation technique; fructose, glucose, phosphate, lactate, and pyruvate concentrations were determined every 10 min; and, in some cases, renal excretion of uric acid was studied. Arterial fructose concentrations reached a peak of about 3 mM five min after infusion was begun and then decreased to 2 mM.

The concentration in the hepatic vein was about 1 mM lower. The uric acid concentration in the hepatic vein increased immediately after fructose infusion was begun, reached a peak after 20-30 min, and then tended to decrease. Arterial concentrations of uric acid remained essentially unchanged, as did uric acid levels in peripheral venous blood. Liver blood flow increased from 85.2 to about 100 ml/100 g liver/min after fructose infusion and then decreased again to its initial value. Fructose infusion increased uric acid production, obtained by multiplying the difference in uric acid concentrations between arterial blood and that from the hepatic vein by liver blood flow, about 8-fold (from 0.07 to 0.6 mg/100 g liver/min) within 10-20 min. After administration of fructose, the lactate concentration increased in blood from the hepatic vein, reaching 2.5 mM in the arterial blood, a level that would be expected to have an effect on renal uric acid excretion. During fructose infusion, uric acid excretion increased to about twice the basal values. It is suggested that ATP, which ordinarily inhibits 5-nucleotidases, is utilized in ketohexokinase-catalyzed phosphorylation of fructose to fructose-1-phosphate. Elimination of this inhibition increases the breakdown of nucleotides, resulting in increased uric acid synthesis.

6834 UDP GLUCURONYLTRANSFERASE AND PHENOLSULFOTRANSFERASE FROM RAT LIVER IN VIVO AND IN VITRO--IV. SPECIES DIFFERENCES IN HARMOL CONJUGATION AND ELIMINATION IN BILE AND URINE IN VIVO. *(Eng.)* Mulder, G. J.; Bleeker, B. (Dept. Pharmacology, State Univ. Groningen, Groningen, The Netherlands). *Biochem. Pharmacol.* 24(16):1481-1484, 1975.

Harmol conjugation and the subsequent elimination of harmol-sulfate and harmol-glucuronide were studied in male Swiss mice, guinea pigs, rabbits, rats and cats. The cystic duct from the gallbladder was ligated, and the bile duct and (in some cases) the vena jugularis externa and urethra were cannulated. Bile and urine were collected fractionally during the 2 hr following the i.v. injection of harmol (20 μM/kg); in the mice and rabbits, urine was collected from the bladder at the end of the experiment rather than in fractions during the experiment. There was no correlation between the rate of bile production and the biliary excretion of the harmol conjugates, nor between the rate of urine production and the urinary excretion of the conjugates. The rabbit and guinea pig nearly exclusively conjugated the harmol with glucuronate, whereas the cat predominantly synthesized the sulfate conjugate. The mouse and rat synthesized both conjugates at high rates, the mouse producing more of the glucuronide conjugate and the rat producing more of the sulfate conjugate. In all species studied, about 21% of the injected harmol was excreted in the urine in conjugated form. In the rabbit, about 9% of the injected dose was excreted in the bile, while in the other species about 33-58% of the injected dose was excreted in the bile. Except for the rabbit, most of the injected harmol was excreted in the bile, harmol-glucuronide being excreted predominantly in the bile (the rabbit being an exception) and the harmol-sulfate being excreted to a large extent in the urine. In most species, the biliary excretion of the harmol conjugates occurred during the first 30 min after injection; in the cat, biliary excretion of harmol occurred during the first 60 min. The data suggest that biliary excretion requires a high liver concentration of the relevant compound for a high excretory rate.

6835 RATE-LIMITING FACTORS IN THE OXIDATION OF ETHANOL BY ISOLATED RAT LIVER CELLS. *(Eng).* Meijer, A. J.; Van Woerkom, G. M.; Williamson, J. R.; Tager, J. M. (Lab. Biochemistry, Univ. Amsterdam, Plantage Muidergracht 12, Amsterdam, The Netherlands). *Biochem. J.* 150(2):205-209, 1975.

To determine whether the rate-determining factor during ethanol oxidation is the activity of the shuttles or flux through the phosphorylating electron-transport chain, ethanol oxidation by liver cells isolated from starved (24 hr) and *ad libitum*-fed male Sprague-Dawley rats was studied. Ethanol uptake and oxidation were measured in the presence of malate, DL-cycloserine, carbonyl cyanide *p*-trifluoromethoxyphenylhydrazone, and amytal. Malate caused a marked cycloserine-sensitive stimulation of ethanol oxidation in the liver cells from the starved rats and a small increase in glucose production; oxygen uptake was not increased. The addition of carbonyl cyanide *p*-trifluoromethoxyphenylhydrazone to the cells from the starved rats did not increase ethanol consumption, unless the cells were preincubated with lactate and guinolinate. At carbonyl cyanide *p*-trifluoromethoxyphenylhydrazone concentrations greater than 6.6 μM, ethanol consumption was inhibited and there was a concomitant decrease in respiratory rate and an increased leakage of lactate dehydrogenase into the medium. Lactate stimulation of ethanol oxidation was shown to have two components: stimulation by an increased energy demand owing to glucose synthesis which was sensitive to quinolate; stimulation by increased activity of the malate-aspartate cycle because of increased malate and aspartate concentrations, which was insensitive to quinolate. The addition of dehydroxyacetone to the liver cells from the starved animals stimulated ethanol uptake by 45% and increased the glycerol 3-phosphate content three-fold. Amytal (1-4 mM) inhibited ethanol uptake by 50% and caused a progressive switch of dehydroxyacetone metabolism from glucose to lactate formation. The rate of ethanol consumption by the cells from the fed rats was two-fold greater than that observed in the cells from the starved rats, and the cellular concentrations of malate, aspartate, and glycerol 3-phosphate were much higher in the former than in the latter. Malate stimulated ethanol consumption in the fed rats, but this effect was inhibited by quinolinate. Carbonyl cyanide *p*-trifluoromethoxyphenylhydrazone also stimulated ethanol oxidation in the fed rats, but malate was ineffective. Thus, in the cells from the starved rats, the transfer of reducing equivalents from the cytosol to the mitochondria appears to be regulated by the intracellular concentrations of the intermediates of the malate-aspartate and glycerol 3-phosphate cycles, as well as by flux through the respiratory chain.

6836 CHANGES IN SOME CLINICAL CHEMICAL PARAMETERS IN THE SERUM OF SUBJECTS GIVEN ALCOHOL FOLLOWING CONTINUOUS INHALATION OF CARBON DISULFIDE. *(Ger.)* Freundt, K. J.; Lieberwirth, H. (Institut Toxikologie und Pharmakologie, Universitat, D-8700 Wurzburg, Koellikerstrasse 2, Germany). *Zentralbl. Arbeitsmed.* 24(9):266-271, 1974.

Serum cholesterol, $Ca^{++}$, inorganic phosphate, total bilirubin, albumin, total protein, uric acid, nonprotein nitrogen, glucose, LDH, alkaline phosphatase, and SGOT were measured in 11 normal males, aged 20-32 yr and weighing 64-98 kg, who were exposed to carbon disulfide ($CS_2$) concentrations of 20, 40, or 80 ppm for eight-hr periods once or on two or five consecutive days. These subjects were fed a standard diet and, to maintain a blood alcohol level of approximately 0.07%, 0.57 mg/kg ethanol in 3.01 ml/kg orange juice at the beginning of the test period and 0.047 ml/kg ethanol in 0.18 mg/kg orange juice every 15 min thereafter for eight hr. Controls consisted of subjects fed the same diet who were not exposed to $CS_2$ or who were exposed to 20 ppm $CS_2$ but given no alcohol. Total serum bilirubin increased and blood glucose decreased in subjects given alcohol and exposed to 80 ppm $CS_2$ for eight hr. Total serum bilirubin, albumin, total protein, uric acid, and alkaline phosphatase increased in subjects given alcohol 16-24 hr after an eight-hr exposure to 20 ppm $CS_2$. When subjects were exposed to 20 ppm $CS_2$ for eight-hr periods on each of five consecutive days and given alcohol over the last eight-hr exposure period, total serum bilirubin increased and glucose and SGOT decreased. Serum glucose concentrations also decreased in controls who were given alcohol but were not exposed to $CS_2$. All of these changes were significant ($0.1 < p < 0.05$), but values were above the normal range in only a few cases. No changes occurred in any of the parameters measured when subjects were exposed for 8 hr to 40 ppm $CS_2$ and given alcohol or when they were exposed to 20 ppm $CS_2$ for 8 hr without alcohol. These findings indicate that occupational exposure to $CS_2$ concentrations of 20 ppm or less in subjects who drink moderate amounts of alcohol causes no pronounced changes in any metabolic reactions routinely measured.

6837 THE EFFECT OF ETHYL ALCOHOL ON HEME AND PORPHYRIN SYNTHESIS IN RAT LIVER. *(Ger.)* Held, H. (Med. Univ. Klinik, Tubingen, Germany). *Verh. Dtsch. Ges. Inn. Med.* 80:481-484, 1974.

Administration of 2 g/kg ethanol p.o. to rats which had been fasted for 48 hr doubled or tripled Δ-aminolevulinic acid (ALS) synthetase activities within three hr but had no effect on ALS dehydratase or drug-metabolizing decarboxylase, as measured by hexobarbital degradation and the cytochrome P-450 concentration. The ALS synthetase activity returned to normal 6 hr after administration of ethanol. From eight to 24 hr after administration of ethanol, the total porphyrin concentration in the livers of these rats was increased significantly to a maximum of 75% of the initial value. As anticipated, in fasting rats given 80 mg/kg phenobarbital 48 hr before administration of ethanol, hexobarbital decarboxylase was induced and cytochrome P-450 concentrations doubled or tripled. The increase in ALS synthetase activities which occurred after administration of ethanol in phenobarbital-treated rats was greater than that in rats given ethanol alone and reached as high as 10 times the original values. However, 16 hr after injection of phenobarbital, enzyme activities had returned to their initial levels. These findings suggest that phenobarbital sensitizes the liver to ethanol. The induction of ALS synthetase cannot be due to changes in cytochrome P-450 concentrations in the hepatocytes but is probably due to changes in intermediary metabolism in the liver.

6838 EFFECT OF CHRONIC ETHANOL INGESTION ON FATTY ACID OXIDATION BY HEPATIC MITOCHONDRIA. *(E.)* Cederbaum, A. I.; Lieber, C. S.; Beattie, D. S.; Rubin, E. (Mount Sinai Sch. Medicine, City Univ. New York, N.Y. 10029). *J. Biol. Chem.* 250(13): 5122-5129, 1975.

To further investigate the pathogenesis of fatty liver, the effect of chronic ethanol ingestion was studied in liver mitochondria isolated from male Sprague-Dawley rats. Oxygen uptake with various fatty acids as substrates was measured. State 3 uptake was depressed to a greater extent (75.80 and 54.2 natoms/min/mg of protein for control and ethanol-treated, resp.) than State 4 respiration (20.93 and 18.0 natoms/min/mg of protein, resp.), using 15 μM of palmitoyl-l-carnitine as a substrate. Values with other fatty acids as substrates were similar. $CO_2$ production from palmitate was reduced 37% in mitochondria from ethanol-fed rats, comparable to the 32% decrease seen in State 3 oxygen consumption. $CO_2$ production from octanoate was reduced 20% by ethanol feeding, similar to the 17% decrease in State 3 oxygen consumption. Palmitoyl coenzyme A (CoA) synthetase activity was not affected by ethanol feeding. Carnitine palmitoyltransferase activity was stimulated 30%. Ethanol feeding had no effect on the endogenous rate of ketone body production. However, the addition of palmitoyl-l-carnitine or palmitate increased ketone body production about 4-fold. Fatty acid oxidation under anaerobic conditions, with the use of artificial electron transport acceptors to reoxidize NADPH, was studied. In the presence of fluorocitrate, ketogenesis and formazan production were increased by chronic ethanol feeding. It is concluded that chronic consumption of ethanol leads to persistent impairment of mitochondrial oxidation of fatty acids to $CO_2$, even though oxidation of fatty acids to acetyl-CoA is not decreased.

6839 EFFECT OF ACETALDEHYDE ON FATTY ACID OXIDATION AND KETOGENESIS BY HEPATIC MITOCHONDRIA. *(E.)* Cederbaum, A. I.; Lieber, C. S.; Rubin, E. (Mount Sinai Sch. Medicine, City Univ. New York, N.Y. 10029). *Arch. Biochem. Biophys.* 169(1): 29-41, 1975.

To determine whether acetaldehyde may play a role in ethanol-induced steatosis, the effects of acetaldehyde on fatty acid oxidation by isolated rat liver mitochondria were studied. The mitochondria were incubated with 0.6 to 12.0 mM of acetaldehyde and the effects on mitochondrial oxygen consumption, $CO_2$

production, ketone body production, acetyl CoA content, and palmitoyl-CoA synthetase and carnitine-palmitoyltransferase activity were determined. State 3 (coupled) oxygen consumption was inhibited by acetaldehyde in concentrations as low as 0.6 mM, while state 4 (resting) respiration was significantly inhibited only by 12 mM of acetaldehyde. Ethanol (12, 40 and 80 mM) had no effect on oxygen consumption. Acetaldehyde also caused a decrease in the respiratory control ratio associated with the oxidation of palmitoyl-l-carnitine and palmitoyl CoA; ethanol had no such effect. Acetaldehyde depressed ketone body production as well as the content of acetyl CoA during palmitoyl-l-carnitine oxidation, acetaldehyde being considerably more inhibitory toward fatty acid oxidation than was acetate. Oxygen uptake was depressed by acetaldehyde to a slightly, but consistently, greater extent in the absence of fluorocitrate than in its presence. The formation of $CO_2$ from palmitate was strikingly reduced by acetaldehyde; $CO_2$ production was much more sensitive to inhibition by acetaldehyde than was oxygen consumption. The inhibitory effect of acetate on $CO_2$ production was considerably less than that of acetaldehyde, and the oxidation of acetate to $CO_2$ was depressed by acetaldehyde. The results suggest that acetaldehyde-induced inhibition is not mediated by acetate, and that the inhibition of fatty acid oxidation is not due to any effect on the activation or translocation of fatty acids into the mitochondria. Acetaldehyde appears to inhibit β-oxidation, citric acid cycle activity, and the respiratory-phosphorylation chain. Neither the activities of palymitoyl CoA synthetase nor carnitine palmitoyltransferase appear to be rate limiting for fatty acid oxidation. The inhibition of fatty acid oxidation by metabolites of ethanol oxidation (acetaldehyde) may contribute to the steatosis observed after chronic ethanol treatment.

6840 ACETALDEHYDE OXIDATION BY HEPATIC MITOCHONDRIA: DECREASE AFTER CHRONIC ETHANOL CONSUMPTION. *(E.)* Hasumura, Y.; Teschke, R.; Lieber, C. S. (Veterans Admin. Hosp., Bronx, N.Y. 10468). *Science* 189(4204):727-729, 1975.

The effects of chronic ethanol feeding (36% of the total calories in a nutritionally adequate diet for 4 to 5 wk) on the capacity of intact liver mitochondria to oxidize acetaldehyde and the activity of aldehyde dehydrogenase in disrupted mitochondria were studied in pair-fed female Sprague-Dawley rats. Chronic ethanol consumption resulted in a significant reduction in the rate of acetaldehyde metabolism by intact mitochondria *in vitro*. This was associated with decreased mitochondrial respiration with acetaldehyde as substrate. The addition of fatty acids and other substrates for NAD-linked dehydrogenases in mitochondrial respiration further decreased the rate of acetaldehyde oxidation. In contrast, in disrupted mitochondria supplied with NAD, the activity of NAD-dependent aldehyde dehydrogenase was higher in the ethanol-fed rats than in the linked controls. The activity of glutamate dehydrogenase remained unchanged, however. The data suggest that elevated blood acetaldehyde resulting from enhanced ethanol metabolism or decreased disposition may impair mitochondrial functions, including the capacity to oxidize acetaldehyde. This, in turn, will elevate the acetaldehyde concentration in the blood even further, which may then perpetuate injury not only in the liver but possibly also in the heart and brain.

6841 EFFECTS OF CHRONIC ETHANOL ADMINISTRATION IN THE RAT: RELATIVE DEPENDENCY ON DIETARY LIPIDS -- I. INDUCTION OF HEPATIC DRUG-METABOLIZING ENZYMES IN VITRO. *(E.)* Joly, J. G.; Hetu, C. (Hopital Saint-Luc, 1058 St. Denis St., Montreal, Quebec, Canada H2X-3J4). *Biochem. Pharmacol.* 24(16):1475-1480, 1975.

The importance of dietary lipid, daily ethanol intake, and undernutrition on the effects of ethanol on drug-metabolizing activities *in vitro* was studied in female Sprague-Dawley rats. The animals were pair-fed for 5 to 7 wk on high- or low-fat diets containing 5% or 6% (w/v) ethanol, or were fed *ad libitum* or were given restricted hypocaloric diets for 21 and 28 days, resp. The livers were then removed and the liver microsomes were tested *in vitro* for microsomal demethylation activity, NADPH-cytochrome c reductase, MEOS, protein, and cytochrome P-450. Ethanol given as a 5% solution with high amounts of dietary fat increased cytochrome P-450, the activities of NADPH-cytochrome P-450 reductase, benzphetamine demethylation, aniline hydroxylation, and MEOS. When 5% ethanol was given with a low fat diet, the increases in cytochrome P-450 and P-450 reductase were reduced, but the other enzyme activities were increased to the same extent as seen with the high fat diet. When ethanol was administered as a 6% solution with a low fat diet, caloric deficiency was observed and there was no significant induction of any enzymic parameter except aniline hydroxylation. When 6% ethanol was given with a high fat diet, however, cytochrome P-450 and P-450 reductase, but not MEOS, were increased despite the caloric deficiency. Ingestion of 6% ethanol with the high fat diet resulted in a negligible weight gain. In the animals fed the hypocaloric diet *ad libitum*, growth was impaired by 66% and the liver cytochrome P-450 level was increased, but there were no other significant changes; the caloric intake in these animals was similar to that in the 5% ethanol-high fat and 6% ethanol-low fat groups. In the animals fed the restricted hypocaloric diet, significant increases in cytochrome P-450, NADPH-cytochrome P-450 reductase, and benzphetamine demethylation were observed, and aniline hydroxylation was nonsignificantly elevated; the caloric intake in these animals was similar to that in the 6% ethanol-high fat group. The data indicate that the induction of drug-metabolizing enzymes by ethanol is partially dependent on dietary lipids, as well as on the amounts of ethanol ingested and on the nutritional status of the animal.

6842 ALCOHOL-INDUCED TESTICULAR ATROPHY: AN EXPERIMENTAL MODEL FOR HYPOGONADISM OCCURRING IN CHRONIC ALCOHOLIC MEN. *(E.)* Van Thiel, D. H.; Gavaler, J. S.; Lester, R.; Goodman, M. D. (Univ. Pittsburgh Sch. Medicine, Pittsburgh, Pa. 15261). *Gastroenterology* 69(2):326-332, 1975.

The effect of chronic alcohol ingestion (*via* a liquid diet in which ethanol accounted for 36% of the total

calories) on testicular growth, development and function was studied in male Wistar rats aged 20 days at the start of the experiment. The ethanol-fed animals and a group of pair-fed controls were killed at 61 days of age and the liver, testes, prostate gland, seminal vesicles and pituitary glands were weighed and examined histologically. The plasma testosterone and serum total bilirubin, alkaline phosphatase, and glutamic pyruvic transaminase levels were also determined. *Ad libitum*-fed controls gained weight steadily until 60 days of age, and the testes, prostate and seminal vesicles increased in mass until reaching adult size and histologic appearance at 40 days of age; the plasma testosterone concentrations reached adult levels at 40 to 50 days. At death, the ethanol-fed rats showed a significant reduction in testicular mass relative to body weight compared to their pair-fed controls, although the absolute testicular mass of the latter was reduced compared with that of the *ad libitum*-fed controls. The reduction in testicular mass in the alcohol-fed rats was due primarily to a reduction in the mean seminiferous tubular diameter and the amount of germinal epithelium within the tubules. Leydig cell function was also disturbed in the ethanol-treated animals; there was a significant reduction in the ventral prostate and seminal vesicle mass relative to body mass, and the histologic appearance of the seminal vesicles and ventral prostate was one of complete androgen deprivation. In addition, the plasma testosterone concentrations in the ethanol-fed rats were significantly reduced in comparison with the pair-fed and *ad libitum*-fed controls. However, the pituitaries of the three groups showed no apparent histologic differences. Despite the fact that the body mass was significantly reduced in the ethanol-fed rats compared with the pair-fed controls, the liver weight and ratio of liver mass to body mass were increased in the former as compared with the latter. Although fatty metamorphosis was present in the livers of the ethanol-fed rats, there was no histologic evidence of acute inflammation, necrosis or portal fibrosis, and liver function tests were within normal limits. The data support the view that ethanol is a primary testicular toxin.

6843 EFFECT OF LIFETIME EXPOSURE TO AFLATOXIN $B_1$ IN RATS. *(E.)* Ward, J. M.; Sontag, J. M.; Weisburger, E. K.; Brown, C. A. (Natl. Cancer Inst., Bethesda, Maryland 20014). *J. Natl. Cancer Inst.* 55(1):107-113, 1975.

The effects on rats of exposure to aflatoxin $B_1$ ($AFB_1$) through transplacental and milk metabolites, followed by lifelong dietary exposure, was studied. Pregnant F344 rats were fed a diet containing 2 ppm $AFB_1$ throughout gestation and lactation, and the waned offspring were fed the same diet until they died. For comparison, this diet was also administered to another group of rats beginning at age six or seven weeks. The survival of male rats was significantly shorter than that of females of both groups, i.e., 45.6 *versus* 61.6 weeks in the group exposed from conception and 50.2 *versus* 63.1 weeks in the group exposed from six or seven weeks. The major causes of death were rupture of a hemorrhagic liver tumor and hemoperitoneum or pulmonary metastases with or without hemothorax. Histologically, the hemorrhagic liver tumors were hemangiosarcomas composed of poorly differentiated cells resembling endothelial cells. Nodules of hyperplasic liver cells sometimes became quite large (> 1.5 cm), and two were successfully transplanted. The hemangiosarcomas rapidly induced pulmonary metastatses upon s.c. transplantation into weanling and young adult rats, but did not elevate serum α-fetoprotein levels in recipients. After 20 serial passages, the morphology of the tumor resembled that of the original primary liver tumor. Colon tumors also appeared in more than 20% of the rats exposed *in utero* or given $AFB_1$ at six or seven weeks. These tumors were primarily polyploid neoplasms in the descending colon. A few rats had tumors of the kidney, oral cavity, and hematopoietic system. These results indicate that $AFB_1$ should be considered a colonic as well as a hepatic carcinogen.

6844 DIVERSE EFFECTS OF ANTIOXIDANTS ON CARBON TETRACHLORIDE HEPATOTOXICITY. *(E.)* De Ferreyra, E. C.; Castro, J. A.; Gomez, M. I. D.; D'Acosta, N.; De Castro, C. R.; De Fenos, O. M. (Laboratorio de Quimica Bio-Toxicologia, CITEFA, Zufriategui y Varela, Villa Martelli, Pica. de Buenos Aires, Argentina). *Toxicol. Appl. Pharmacol.* 32(3):504-512, 1975.

The diverse effects of *in vitro* antioxidants on carbon tetrachloride hepatotoxicity were investigated in Sprague-Dawley rats. The prior treatment of animals with oil solution of α-tocopherol acetate did not have an effect on $CCl_4$ concentrations in liver when the hepatotoxin was given p.o. or i.p. and determinations were performed at intervals up to 3 hr. Similarly, the content of $CCl_4$ in livers of rats pretreated with a saline solution of 25 mg/kg promethazine was not significantly different from that of the untreated animals given $CCl_4$ i.p. Oil suspensions of 600 mg/kg *N,N'*-diphenyl-*p*-phenylenediamine were not able to modify the amount of $CCl_4$ reaching the liver 1, 3, or 6 hr after oral administration of $CCl_4$. Water suspensions were able to significantly modify the 1-hr concentrations in liver of $CCl_4$ given p.o. Significant decreases were found in $CCl_4$ concentrations in the liver when water suspensions of *N,N'*-diphenyl-*p*-phenylenediamine were used and $CCl_4$ was given i.p. The effect was observed at 3 hr but was more pronounced at 6 hr. Oil suspensions did not produce significant differences in $CCl_4$ concentrations in liver at 1 or 3 hr in rats given $CCl_4$ i.p. α-Tocopherol acetate did not modify the extent of the irreversible binding of $^{14}C$ to microsomal lipids, but *N,N'*-diphenyl-*p*-phenylenediamine decreased it significantly. α-Tocopherol acetate, *N,N'*-diphenyl-*p*-phenylenediamine given either as oil or water suspensions, as well as promethazine, were not able to prevent the $CCl_4$-induced lipid peroxidation at 40 min or 3 hr after $CCl_4$ administration. These results weaken the value of previous findings with antioxidants which were used to support the lipid peroxidation theory of $CCl_4$ hepatotoxicity.

6845 EFFECT OF 17α-ETHINYLESTRADIOL ON BILIARY EXCRETION OF BILE ACIDS. *(E.)* Watanabe, H. (Drug Res. Lab., Dep. Natl. Health Welfare, Ottawa, Canada). *Biochim. Biophys. Acta* 399(1):79-84, 1975.

The effects of 17α-ethinylestradiol on bile acid excretion and metabolism were studied in female Wistar rats. The common bile duct was cannulated, and for 3 days prior to bile collection all animals were fed cholestyramine (3% added to a ground fox cube diet). 17α-Ethinylestradiol in 10% ethanolic saline was administered by oral intubation daily for 4 days at a dose level of 1, 10, 25, 50, 100 or 250 μg; controls received ethanolic saline. In another group of cholestyramine-treated and untreated rats, 17α-ethinylestradiol was administrred for 1 to 10 days at a dose level of 500 μg. Eighteen hr after the last dose of steroid, bile samples were collected over a 3-hr period. The bile salts were extracted, hydrolyzed, methylated, and analyzed by gas-liquid chromatography. The ratio of cholate to chenodeoxycholate was progressively diminished by estrogen treatment up to 25 μg. At dose levels between 50 and 250 μg, there were no further increases in the chenodeoxycholate levels nor further declines in the cholate:chenodeoxycholate ratio. There was a tendency towards a decrease in cholate levels in this dose range, the reduction also being apparent in animals treated with 500 μg of estrogen. Prolonged treatment with 500 μg/day of 17α-ethinylestradiol produced a progressive reduction in the excretory rate of both bile acids in cholestyramine-treated and untreated animals. The effects of various other estrogens were similar to those of 17α-ethinylestradiol while various progestins were without effect. The responses were similar following p.o. and s.c. treatment. The results indicate that 17α-ethinylestradiol in low doses stimulates chenodeoxycholate excretion, whereas in high doses it reduces cholate excretion.

6846 CAERULEIN EFFECT ON THE BILIARY EXCRETION OF COLORANTS. *(E.)* Angelucci, L.; Linari, G.; Baldieri, M. (Inst. Pharmacol. Pharmacognosy, Univ. Rome, Italy). *Pharmacol. Res. Commun.* 7(4): 311-322, 1975.

The effects of cerulein (15-50 ng/kg/min, i.v.) on the biliary excretion and plasma concentration of BSP (200-600 or 1000 μg/kg/min, i.v.) and rose bengal (RB, 100-175 μg/kg/min, i.v.) were studied in lightly anesthetized white Leghorn-Rhode Island chickens. In some experiments both hepatic bile ducts were cannulated so that the enterohepatic circulation of bile salts was totally interrupted; in other experiments, only the left duct was cannulated. Also, in some experiments, Na taurocholate was given by continuous i.v. infusion (200 μg/kg/min) throughout. Cerulein stimulated bile flow during BSP (200-600 μg/kg/min) administration in the absence of an enterohepatic circulation of bile salts. Bile salt output and biliary BSP output were unaffected. When Na taurocholate was infused with BSP under similar conditions, cerulein stimulated choleresis and increased the output and concentration of bile salts. The biliary excretion of BSP was unaffected, as were plasma levels of the colorant. In animals receiving BSP at a rate of 1000 μg/kg/min, however, cerulein did stimulate the biliary excretion of the colorant and also affected its plasma levels. During BSP administration (500 μg/kg/min) in the presence of a partial enterohepatic circulation of bile salts, cerulein (25 ng/kg/min) produced an intense total choleresis, an increase in bile salts output and concentration, and increases in the biliary excretion and plasma levels of BSP. Similar results were found during the administration of RB. The results indicate that cerulein increased the biliary excretion of BSP and RB only when the colorants were infused at rates higher than the maximum liver transport capacity (Tm) and when some bile salt was available for secretion. It appears that cerulein, by increasing choleresis, reduces the limiting factor to the excretion of colorant into bile under liver Tm conditions, i.e., its concentration in the canalicular bile.

6847 MORPHOLOGICAL ASPECTS OF TREATING PATIENTS WITH CHOLECYSTITIS WITH CHENODEOXYCHOLIC ACID. *(Ger.)* Leuschner, U. (Cent. Intern. Med., Johann Wolfgang Goethe Univ., Frankfurt/Main, Germany). *Z. Gastroenterol.* 13:309-313, 1975.

To determine whether therapeutic doses of chenodeoxycholic acid are hepatotoxic, 20 mg/kg doses were administered p.o to rats for 5 to 60 days. The animals were then sacrificed, and the entire gastrointestinal tract was examined by light and electron microscopy; findings were compared to those from untreated controls. In two of the five rats examined, bile capillaries were dilated and contained lipid-like material; the villi had completely disappeared after 20 days of treatment. After 60 days of treatment, light vacuoles were present in hepatocyte cytoplasm along intercellular spaces and right below the outer cell membranes. Digitate or cystic dilatations of the intercellular space were detected which, in some cases, resembled bile capillaries. Since the contents of cytoplasmic vacuoles resembled those of the intercellular cysts, it is suggested that these structures are inclusion vacuoles arising from invagination of the outer cell membrane and that they contain substances normally secreted in the bile. These findings demonstrate that doses of chenodeoxycholic acid, similar to those given to patients with cholesterol gallstones, are hepatotoxic to rats although chenodeoxycholic acid and its derivative, lithocholic acid, may be readily detoxified by 6β-hydroxylation. Abnormalities found in the jejunal epithelium consisted of deposits of fat in submembranous vesicles and supranuclear deposits of highly osmiophilic, lipid-like substances. Many cells were swollen, and microvilli were broader and coarser than in untreated controls. In rats given chenodeoxycholic acid for 60 days, a decrease occurred in the number of villi and in their length, and the terminal reticulum was dispersed in some cells found in the ileum. These changes might be a manifestation of disorders in the electrolyte and water balance.

6848 TOXICITY OF CHENODEOXYCHOLIC ACID IN THE RHESUS MONKEY. *(E.)* Dyrszka, H.; Chen, T.; Salen, G.; Mosbach, E. H. (New Jersey Medical Sch., Newark, N.J.). *Gastroenterology* 69(2):333-337, 1975.

To determine the mechanism of toxicity of chenodeoxycholic acid, the bile acid was administered daily (10, 40 or 100 mg/kg, p.o.) for 1 mo to male and female rhesus monkeys; control animals were given placebo.

The animals were killed after 33 days of bile acid administration or 9 days after the cessation of treatment. Changes in the blood and serum values, biliary lipids, and liver tissue were recorded. The serum leucine aminopeptidase values increased in proportion to the dose of chenodeoxycholic acid administered. The total blood count, SGOT, serum bilirubin, serum total protein and albumin, serum cholesterol, blood urea nitrogen, creatinine, electrolytes and blood glucose levels remained within normal limits in all treatment groups. Bile acid administration caused a marked decrease in the proportion of cholic acid and deoxycholic acid in the bile, and chenodeoxycholic acid became the major component of the biliary acids. The proportion of lithocholic acid also increased seven- to ten-fold; in the 40 and 100 mg/kg groups it exceeded the amount of cholic acid and deoxycholic acid. There were no significant changes in the biliary phospholipid or cholesterol concentrations. The bile acid composition had markedly improved in the animals killed 9 days after cessation of bile acid treatment. Liver biopsies obtained before treatment and at necropsy showed no significant histological changes. The data indicate that the hepatic toxicity which developed following the administration of chenodeoxycholic acid may result from an inability to metabolize chenodeoxycholic acid itself or its bacterial metabolite, lithocholic acid.

6849 CIRRHOSIS OF CHOLINE DEFICIENCY IN THE RHESUS MONKEY. POSSIBLE ROLE OF DIETARY CHOLESTEROL. *(E.)* Patek, A. J., Jr.; Bowry, S.; Hayes, K. C. (Veteran's Administration Hosp., Boston, Mass. 02130). *Proc. Soc. Exp. Biol. Med.* 148(2):370-374, 1975.

The production of cirrhosis by a choline-deficient diet lacking peanut meal and cholesterol was studied in adult rhesus monkeys. The monkeys were fed a basic choline-deficient diet, the same diet with added choline, or commercial chow. After 14 months, the animals which had been maintained on the basic choline-deficient diet were divided into two groups; one group received the original diet, and the second received a cholesterol supplement comprising 2% of the diet. The experiment was continued for a total of 31 months. Venous blood samples and needle biopsies of the liver were examined at 3-month intervals. Growth rates were similar in all groups, and the blood chemistries were normal except in two animals which developed cirrhosis, and in the protein- and choline-deficient animals; the latter developed a moderate anemia and hypoalbuminemia. Patch alopecia developed in several animals fed the cholesterol supplement. The livers of the animals fed the choline-deficient diet and the choline-supplemented diet showed slight fatty changes, fine vacuolation, and ballooning of the hepatocytes. A sharp increase in fat was seen in the livers of the animals fed supplemental cholesterol. Cirrhosis developed in one animal after 26 months on the choline-deficient diet and in another monkey after 2 months on the cholesterol-supplemented diet. Electron microscopy showed depletion of cytoplasmic constituents in the animals fed the low-protein diets, but no other changes. The data indicate that the rhesus monkey can develop choline-deficiency cirrhosis, although it is less susceptible than the rat. The addition of cholesterol to the diet appears to exert an hepatotoxic effect.

6850 ULTRASTRUCTURAL STUDIES OF THE HEPATOCYTES AFTER CHRONIC EXPOSURE TO LOW LEVELS OF HALOTHANE. *(E.)* Chang, L. W.; Dudley, A. W.; Lee, J. K.; Katz, J. (Dept. Pathology, Univ Wisconsin, Madison, Wis. 53706). *Exp. Mol. Pathol.* 23(1):35-42, 1975.

Electron microscopy (EM) was used to study the pathological effects on the liver of long-term, chronic exposure to low levels of halothane. Adult Sprague-Dawley rats of both sexes were used. Halothane exposures were 10 ppm, 8 hr/day, five days/wk for 8 wk and 500 ppm, 8 hr/day, five days/wk for 4 wk. EM study of the low dose liver tissue showed an increase in matrical density of the mitochondria and some C-shaped transformation. There was also an accumulation of floccular, electron-dense material around the rough endoplasmic reticulum. At the higher dose, severe dilation of bile canaliculi was observed with a flattening and loss of microvilli; extrusion of cellular debris with peribiliary accumulation of electron-dense bodies, presumed to be lysosomes, was also evident. Occasionally, large, membrane-limited floccular bodies containing remnants of cytoplasmic material (focal cytoplasmic degradation) were observed. Halothane was concluded to have a direct hepatotoxic effect.

6851 METHIONINE-INDUCED HEPATIC COMA IN DOGS. *(E.)* Merino, G. E.; Jetzer, T.; Doizaki, W. M. D.; Najarian, J. S. (Univ. Minnesota Hosp., Minneapolis, Minn.). *Am. J. Surg.* 130:41-46, 1975.

The relation between p.o. methionine doses and blood ammonia and methanethiol levels was analyzed. Mongrel dogs (19) were given portacaval shunts and fed a daily diet containing 25 g of protein and 40 g of lipids. Fasting ammonia level was measured daily before feeding, and liver enzyme and electrolyte levels were measured every third day. Of the dogs, 11 were fed methionine (25 g every 4 hr) *via* nasogastric tube as a 50% aqueous suspension until the animal became comatose. The remaining 8 plus 8 nonshunted dogs served as controls. Ammonia values were monitored every 4 hr during methionine feeding, and blood methionine levels were determined when coma ensued. None of the dogs showed encephalopathy up to the 21st postoperative day, regardless of ammonia level. Methionine feeding was begun when fasting ammonia levels reached 250 to 500 µg/100 ml in three dogs, at 500 to 1000 µg/100 ml in two, at 1000 to 1250 µg/100 ml in three, and at 1250 to 1500 µg/100 ml in three. Coma developed in two dogs after five boluses of methionine, in two after four boluses, in three after three boluses, in two after two boluses, and in one after one bolus. Of 10 episodes of deep or very deep coma, three were fatal, and seven other abnormal neurologic conditions were classified as subcoma. Average fasting ammonia levels remained stable around 450 µg/100 ml, and gradually increased to 750 µg/100 ml over 10 days. SGOT and serum alkaline phosphatase levels rose slowly over the 10 days. Lower methionine

doses (25 g) could trigger coma in dogs with high ammonia levels (over 1250 µg/100 ml) and doses up to 125 g were needed to induce coma when ammonia levels were under 500 µg/100 ml. In the four dogs that died during coma, the pH and electrolyte values showed metabolic acidosis, hypoxemia, hypoglycemia, hypokalemia, thrombocytopenia, hemolysis, and intravascular coagulation during the terminal stages. Methanethiol blood levels increased proportional to the dose given. A 3-fold increase in ammonia level increased the comatogenicity of methanethiol 100-fold. A dog with an ammonia level of 300 µg/ml required 100 times the methanthiol level of one with an ammonia level of 1200 µg/ml to become comatose. Controls showed no evidence of encephalopathy even after massive doses. Infusion of ammonium ions in controls showed concentrations of 5500 and 9000 mg/100 ml blood corresponded to complete coma. In controls, convulsions and coma were induced by 3 to 5 ml 1:40 methanethiol i.v. in 0.1 M NaOH. After injection of 1 ml methanethiol, 1/5 of the previously determined comatogenic dose of ammonia induced encephalopathy. It is concluded oral methionine is comatogenic in dogs with portacaval shunts and with elevated blood ammonia levels.

6852 SIGNIFICANCE OF LIVER CANALICULAR CHANGES AFTER EXPERIMENTAL BILE DUCT LIGATION. *(E.)* De Vos, R.; De Wolf-Peeters, C.; Desmet, V.; Bianchi, L.; Rohr, H. P. (Departement Medische Navorsing, Laboratorium voor Histochemie en Cytochemie, Academisch Ziekenhuis St. Raphael, Katholicke Universiteit Leuven, B-300 Leuven, Belgium). *Exp. Mol. Path.* 23(1):12-34, 1975.

A study was undertaken to analyze the canalicular morphological and histochemical changes in the liver after bile duct ligation and to compare these findings with those present in canaliculi found during the perinatal period. Twenty-one adult male Wistar R rats were subjected to bile duct ligation (BDL). The time interval between surgical intervention and sacrifice was 1, 2, 3, 4, 9, 20 or 40 days. One day after BDL there was an immediate, positive alkaline phosphatase reaction in all canaliculi; this activity was limited to the luminal contents; it remained high during the entire experimental period. EM study revealed progressively increasing dilation of the canaliculi, loss of microvilli and invagination and interdigitation of the hepatocellular plasma membranes. There was pericanalicular ectoplasm surrounding most of these canalicular structures, which were strongly widened, swollen and edematous. Morphometry was used to characterize the diffuse canalicular types. The frequency of the four prototypes of canalicular structures varied depending on the duration of the BDL. These four types were briefly described. Canaliculi found in the perinatal liver corresponded to type 3 (inactive) canaliculi of BDL ducts. The data point to an evolution in the morphological appearance of the biliary pole of the hepatocytes after BDL as well as the newly formed canalicular structures.

6853 REVERSIBILITY OF MORPHOLOGICAL CHANGES IN THE LIVER FOLLOWING EXPERIMENTAL BILE DUCT OBSTRUCTION. *(Ger.)* Schweizer, P.; Reifferscheid, P. (Chirurgische Universitatsklinik, 74 Tubingen, Calwer Strasse /, Germany). *Z. Kinderchir.* 15(2): 174-187, 1974.

The common bile duct was ligated and excised between the duodenum and the outlet of the cystic duct in two-day-old female swine. Bile flow was then restored four, six, or eight weeks after surgery by performing a cholecystoduodenostomy. Controls consisted of six sham-operated swine. Morphometric analysis of liver sections, determinations of serum bilirubin, serum enzymes (SGOT, SGPT, γ-glutamate transaminase, leucine aminopeptidase, and alkaline phosphatase), and the Quick test, and measurements of portal venous pressure revealed that changes induced by bile duct ligation were reversible if bile flow was restored four to five weeks after ligation. If drainage operations were performed later, the progress of fibrosis could no longer be arrested. After fibrous tissue extended throughout the lobules of the liver, increases in portal venous pressure became irreversible. The transition from reversible to irreversible changes in the liver could be established by the ratio of glutamate transaminase/leucine aminopeptidase: this ratio was 1 in normal animals and larger in swine with changes in the hepatic lobules. Much less fibrosis and less severe portal hypertension were found in swine with extensive adhesions between the small intestine and the porta hepatis than in swine who did not develop adhesions. Biochemical findings normalized four weeks after bile duct ligation in swine with such adhesions. It is suggested that this is due to drainage of bile through lymphatic anastomoses between the hepatoduodenal ligament and the small intestine. This hypothesis is supported by the appearance of spots of bile on the cut surface when adhesions were separated.

6854 EFFECT OF PORTACAVAL SHUNT AND ARTERIALIZATION OF THE LIVER ON BILE ACID METABOLISM. *(E.)* Horak, W.; Gangl, A.; Funovics, J.; Grabner, G. (Dept. Gastroenterology, Univ. Vienna, Vienna, Austria). *Gastroenterology* 69(2):338-341, 1975.

The clearance of endogenous bile acids which normally reach the liver *via* the portal vein was studied in mongrel dogs subjected to portacaval end-to-side shunt with and without arterialization of the hepatic portal venous bed. Blood was obtained from the portal and peripheral veins before surgery, postoperatively, and at two-wk intervals thereafter for determination of bile acids and routine laboratory tests. Ten wk after surgery, liver biopsies were obtained and the dogs were killed and the livers weighed. Portacaval shunting caused a 75% decrease in the total hepatic blood flow; this was prevented by arterialization of the shunted liver. Body weight remained constant in all animals, but the liver weight was significantly reduced in the animals subjected to portacaval shunt. The liver mass in the arterialized dogs did not differ significantly from that in the normal controls or in the animals subjected to portacaval shunt only. Serum bilirubin levels remained constant in all animals. However, SGOT was increased in the shunted but not in the arterialized animals, and the serum ammonia and bile acid concentrations were increased postoperatively in both groups, but to a significantly greater extent in the shunted animals. Total serum cholester-

ol declined significantly in both groups after surgery. Clearance was significantly reduced in the shunted dogs, but remained at normal values in the arterialized dogs. There was a linear correlation between hepatic bile acid clearance and total liver blood flow. The data indicate that portacaval shunt combined with arterialization of the liver is associated with less severe histological and biochemical problems than portacaval shunt alone.

6855 ACUTE BIOCHEMICAL AND HISTOLOGICAL EFFECTS OF PORTACAVAL SHUNT IN THE NORMAL RAT. *(E.)* Meyers, O. L.; Hickman, R.; Keraan, M.; Engelbrecht, G. H. C.; Webber, B. L.; Terblanche, J. (Dep. Medicine, Univ. Cape Town, South Africa). *S. Afr. Med. J.* 49(26):1048-1050, 1975.

The early course of changes in total serum protein and evidence of liver damage were studied after portacaval shunt. Five groups of 12 rats each were given end-to-side portacaval shunts or were sham operated in a random distribution. Four groups were killed at 6, 24, 48, and 96 hr after surgery and exsanguinated. A final group of six was killed at 24 hr without exsanguination. Liver biopsies were studied by light microscopy and blood samples were subjected to protein electrophoresis and analyzed for antibacterial lipopolysaccharide antibodies and aspartate aminotransferase. Mean albumin levels were similar in shunt and control rats up to 72 hr; at 96 hr levels were significantly higher in the controls. Mean albumin levels fell during the four days in both groups. In the α-globulin fraction in controls, $\alpha_1$and $\alpha_2$ levels rose, but in shunt rats $\alpha_1$ levels only rose. The greatest difference between the two groups was in the β-globulin fraction, which rose significantly in 24 hr in the controls, but fell in the shunt rats. Neither group showed a significant change in γ-globulin levels. There was no rise in antibacterial lipopolysaccharide bodies in any animals. Aspartate aminotransferase showed a ninefold increase in shunted rats from 139.1 Karmen U preoperatively. Controls showed a two-fold increase. Values returned to normal in all rats after 72-96 hr. There was no difference between exsanguinated and nonexsanguinated rats. Biopsies from shunted rats six and 24 hr after surgery showed marked hepatic necrosis. Aspartate aminotransferase levels were significantly elevated. At 48 and 96 hr these areas were undergoing phagocytosis and regeneration; aspartate aminotransferase levels returned to normal. There was minimal collapse of hepatic architecture by day five. It is concluded that portacaval shunt results in hepatocellular damage which returns to normal within 48 hr; shunted animals maintain albumin levels better than sham-operated controls.

6856 CHOLESTEROL AND BILE ACID METABOLISM AFTER RESECTION OF THE SMALL INTESTINE. *(Ger.)* Weis, H. J.; Dietschy, J. M.; Baas, E. V. (I. Med. Klinik Univ. Mainz, Germany). *Verh. Dtsch. Ges. Inn. Med.* 80:419-421, 1974.

Surgery was performed on the small intestine in three groups of 10 rats each: (1) resection of the distal half of the small intestine and anastomosis of the ends; (2) resection of the proximal half of the small intestine and anastomosis of the ends; and (3) sham surgery in which the ileum was cut and anastomosed. The rats were then fed 15 g/day of rat food for seven weeks. Jejunectomized rats weighed the same as controls, while ileectomized rats weighed significantly less. This decrease in body weight can be accounted for by excretion of fat in the stools which was twice as high in ileectomized rats as in the other two groups. In all three groups, serum cholesterol levels decreased slightly between days three and nine after surgery and then reached a plateau above the initial values. Cholesterol synthesis in the liver and intestine, studied by incubation of tissue slices with 2-$^{14}$C-acetate, remained unchanged after jejunectomy but tripled after ileectomy. Surgery had no effect on $CO_2$ and fatty acid production in the liver. After jejunectomy, the rate of cholesterol synthesis was significantly higher in the proximal ileum than in controls, while in ileectomized rats cholesterol was synthesized at three times the control value in the jejunum. If the total weight of the small intestine is taken into account in determining cholesterol synthesis, the small intestine of rats in groups (1) and (2) synthesized almost the same amount of cholesterol as that of the controls. Determinations of sterols in the stools revealed that ileectomized rats excreted significantly more neutral and acid sterols than the other two groups of animals. This was also demonstrated indirectly by the decreased taurocholic acid pool and increased turnover rate in ileectomized rats. It is concluded that in ileectomized rats increased excretion of neutral and acid sterols is compensated for by increased hepatic cholesterol synthesis. This compensatory mechanism could also occur in man and account for failure of ileal bypass surgery to reduce high serum cholesterol levels.

6857 FORMS OF PHYSIOLOGICAL LIVER REGENERATION IN ANIMALS UNDER PROLONGED HYPERBARIC CONDITIONS. *(Rus.)* Dashevskii, B. S,; Kostkin, V. B. (I. M. Sechenov Inst. Evol. Physiol. Biochem., Leningrad, USSR). *Dokl. Akad. Nauk SSSR* 222(1): 254-256, 1975.

The effect of prolonged hyperbary in a helium-oxygen atmosphere on physiological regeneration of the liver was studied in 42 adult rabbits (3 to 3.5 kg). Basic experiments were performed on 16 rabbits in a high-pressure chamber (35 kg/cm$^2$) in an artificially regenerated helium-oxygen atmosphere (with partial pressure of oxygen 0.31-0.36 kg/cm$^2$) and at the temperature of 29 to 30 C. After gradual decompression of the high-pressure chamber, the experimental animals were killed, and small portions of their livers were removed. For determinations of the number of mitoses and binuclear cells, at least 3,000 hepatocytes were used. Mononuclear hepatocytes were examined photometrically. The frequency of mitosis under hyperbaric conditions increased by 35% after 12 hr, but decreased by 42% (with respect to the initial value) after 10 to 17 days, and by 48% after 30 days. The degree of polyploid of hepatocytes (the ratio of tetraploid/diploid cells) decreased steadily with the time of exposure to the high pressure (2.2 initially; 0.50 after 12 hr; 0.45 after 30 days). Finally, the measuements of the population of binuclear

cells showed that this type of cell constantly increased with the time of exposure to high pressure (9% initially; 18% after 12 hr; 24% after 30 days). Considering that physiological regeneration should be accompanied by enhanced cellular proliferation (increased frequency of mitosis), enhanced polyploid, and increased population of binuclear cells, the results showed that only the last one of the three indicated prerequisites was satisfied. On the basis of this fact, it must be concluded that the possibility of physiological regeneration of the liver under prolonged hyperbary is substantially diminished.

6858 THE RELATIONSHIP OF RETICULOENDOTHELIAL DYSFUNCTION AND ENDOTOXEMIA TO SURVIVAL AFTER HEPATIC ISCHEMIA INJURY IN THE BABOON. *(E.)* Di Luzio, N. R.; Olcay, I.; Holper, K.; Drapanas, T.; Trejo, R. (Tulane Univ. Sch. Medicine, New Orleans, La.). *Circulatory Shock* 2(2):77-89, 1975.

The effects of prolonged ischemia on survival, hemodynamics, and hepatocyte and Kupffer cell function were investigated in the subhuman primate. Of 34 baboons (*Papio papio*), 19 were subjected to 60 or 90 min of liver ischemia by total vascular occlusion, 9 served as sham-operated controls, and 6 underwent portacaval shunting and were subdivided into control and experimental groups. Phagocytic activity of the reticuloendothelial system, circulating blood volume, and hepatic blood flow were determined as well as arterial pH and blood gases, total plasma bilirubin, glutamic oxalacetic transaminase, lactic dehydrogenase, ornithine carbamyl transferase activities, and plasma BSP concentration. Determinations were made before occlusion, and at 3, 24, and 48 hr after restoration of flow. Endotoxin determinations were made before, during, and after occlusion. Occlusion for 90 min resulted in 45% survival. Survivors recovered in a few days; the rest died at a mean of 43 hr. Mean arterial pressure decreased 21% within 5 min of occlusion and maintained that level until restoration in the survivors. In the nonsurvivors, pressure decreased by 54%. Recovery of pressure was seen in both groups after restoration. BSP retention was significantly higher in the experimental group (3.27 after 24 hr) than in controls (0.37). When reticuloendothelial function was tested with $^{131}$I-test lipid emulsion, the survivors had a slightly increased i.v. 1/2 time at 3 hr, and increased 120% (to 41 min) at 24 hr. The nonsurvivors had an i.v. 1/2 time of 141 min at 24 hr, significantly higher than that of the survivors. Mean hepatic blood flow decreased 50 to 60% in the 3 hr postocclusion period but returned to normal (21.2 ml/min/kg) at 24 hr in both survivors and nonsurvivors. Blood volume decreased significantly from normal (98.1 ml/kg) three hr after occlusion. Further decreases of 33% and 48% occurred in survivors and nonsurvivors, resp., at 24 hr, these values being significantly different. Plasma samples from either portal vein and the femoral artery were negative for endotoxin prior to occlusion, but 60% of the animals were positive after 60 min of ischemia. After an additional 30 min, all were positive. There was no correlation between incidence and magnitude of endotoxemia and survival or nonsurvival. In three portacaval shunt animals that underwent 90 min of ischemia and died, persistent endotoxemia was observed. Peak levels appeared between 6 and 12 hr and ranged from 1.6 to 3.2 mg/ml. Levels declined to 0.5 mg/ml by 24 hr. Phagocytic activity was depressed; the half times at 3 and 24 hr were prolonged 2.4- and 3.8-fold, resp. Depression of reticuloendothelial function and endotoxemia were associated with nonsurvivors, while function was normal in one survivor. One sham-operated animal died after exhibiting depressed phagocytic activity and associated endotoxin increase. It is concluded that 60-90 min of hepatic ischemia was associated with 45% survival and that the degree of reticuloendothelial impairment, but not liver function tests, correlated with survival.

6859 METABOLISM IN THE LIVER DURING CHOLESTASIS. *(Ger.)* Llersch, M.; Hesse, W. (Med. Univ. Klinik, Heidelberg, Germany). *Verh. Dtsch. Ges. Inn. Med.* 80:429-432, 1974.

To study the effect of cholestasis and dihydroxy bile acids on liver metabolism, experiments were performed on isolated, perfused livers from fasting male Sprague-Dawley rats which had undergone bile duct ligation 7 days previously. Livers from intact rats served as controls. Bile duct ligation or addition of free or taurine-conjugated chenodeoxycholic acid (0.25 mM) had no effect on endogenous gluconeogenesis, urea synthesis, or the synthesis of lactate and ammonium chloride. No significant differences in the contents of adenine nucleotides, lactate, pyruvate, 3-hydroxybutyrate, acetoacetate, uridine diphosphate-glucose, or glucose were found in livers from bile-duct-ligated rats and intact controls. The glycogen content of livers from the bile-duct-ligated rats was only 50% of the control value, but this can be explained by a reduced food intake in these rats. Since early cholestasis, a decrease in ATP, and pronounced morphological changes have been reported to occur during perfusion of livers from female Wistar rats with chenodeoxycholic acid, experiments were also performed on these animals. In contrast to reports in the literature, chenodeoxycholic acid had a choleretic action and no changes occurred in the ATP content or in hepatic biosynthesis. Perfusion experiments on livers from normal and bile-duct-ligated rats with oleic acid, however, showed that in cholestatic livers ketone body production from oleic acid was decreased to 66% and endogenous production to less than 50% of normal values. Taurochenodeoxycholic acid further reduced ketone body production from oleate to 45% of normal values, but deoxycholic and free and conjugated chenodeoxycholic acid appeared to have no direct effect on normal liver or livers in which the bile ducts were ligated during perfusion, even though bile-duct-ligated livers took up about 50% of the bile acids from the perfusion medium after bile flow ceased. These findings suggest that cholestasis does not have a direct toxic effect on metabolism in the hepatic mitochondria.

6860 EFFECT OF GASTROINTESTINAL FLORA ON BILE ACID METABOLISM IN THE RAT. *(Fr.)* Sacquet, E.; Van Heijenoort, Y.; Riottot, M.; Leprince, C. (Laboratory Germ-Free Animals, Gif-sur-Yvette, France). *Biochim. Biophys. Acta* 380(1):52-65, 1975.

The action of the microbial flora of the digestive tract on biliary acids metabolism was studied in germ-free and conventional, exposed male Fischer rats. The animals were fed semi-synthetic diet composed of 220 g of casein, 580 g of corn starch, 90 g of corn oil, 50 g of cellulose, 50 g of mineral mixture and a mixture of vitamins for 50 days. The animals also received 44,000 dpm of (4-$^{14}$C) cholesterol/g of the diet for 50 days. Due to the regular intake of labeled cholesterol, an isotopic balance was established, so that various chemical species of bile acids showed the same specific activity. This property was used to study bile acid distribution in the liver, intestines and feces. The bile acids were separated by thin-layer chromatography, and the radioactivity was determined by liquid scintillation counter. The masses of the bile acids were determined by 3-hydroxysteroid dehydrogenase test. The bile acids pool in the small and large intestines and cecum was twice as high in germ-free rats as in conventional rats, but fecal excretion was 20% lower in the former. The total bile acids amounted to 4.4 μM in the liver, 100.8 μM in the small intestine, 57.3 μM in the cecum, and 5.7 μM in the large intestine in germ-free rats, and they were 2.9 μM in the liver, 54.6 μM in the small intestine, 18.8 μM in the cecum and 9.1 μM in the large intestine of conventional rats. Cholic and muricholic acids constituted about 90% of the bile acids found in the small intestine of germ-free rats, while their feces also contained appreciable quantities of alpha-muricholic, chenodeoxycholic, and urodeoxycholic acids. Unidentified bile acids accounted for 20% of the fecal bile acids. This relatively large percentage of unknown bile acids in germ-free rats, compared to 40% unknown bile acids in conventional rat feces, made it impossible to determine the influence of bacterial metabolism on the two main pathways of bile metabolism in the rat.

6861 LIVER METABOLISM AND GLUCOGENESIS IN TRAUMA AND SEPSIS. *(E.)* Imamura, M.; Clowes, G. H. A., Jr.; Blackburn, G. L.; O'Donnell, T. F., Jr.; Trerice, M.; Bhimjee, Y.; Ryan, N. T. (Boston City Hosp., Boston, Mass. 02118). *Surgery* 77(6):868-880, 1975.

To determine whether amino acids are transported to the liver for conversion to glucose or for other purposes, and to study the glucogenic function of the liver, the uptake of glucogenic precursors and the production of glucose by the liver were studied. Healthy male and female pigs were used. Portal and hepatic arterial blood flows were measured and blood samples were obtained. The animals were starved for 4 days, then peritonitis was induced by ligation of the cecum below the ileocecal valve. After 3 more days, hemodynamic measurements and blood samples were repeated, and the surviving animals (15) were killed. The rate of glucogenesis was proportional to the sum of the glucogenic precursors taken up by the liver. Higher rates of glucose production were accompanied by elevated blood insulin values. Hepatic oxygen consumption and the rate of uptake of free fatty acids were also related directly to the glucogenic rate, the correlation coefficients being 0.69 and 0.74, resp. In the absence of shock, the liver function and hepatic energy production remained normal in post-traumatic and septic states. It is concluded that in sepsis the release of glucogenic substrates due to altered metabolism in peripheral tissues determines the rate of hepatic glucogenesis.

6862 ACTIVE CHRONIC HEPATITIS. ANIMAL MODEL: CHRONIC MURINE HEPATITIS INDUCED BY REOVIRUS TYPE 3. *(E.)* Stanley, N. F.; Joske, R. A. (Dept. Microbiology, Univ. Western Australia, Nedlands, 6009, Western Australia). *Am. J. Pathol.* 80(1):181-184, 1975.

Observations are reported of 20 yr experience with chronic murine hepatitis induced in more than 100,000 mice by reovirus type 3. Mice surviving a neonatal oronasal infection with the virus develop a progressive disease. Chronic hepatitis is a constant feature; affected mice are runted and jaundiced. These mice usually show a polymorphonuclear leukocytosis, with no evidence of bacterial infection and no antibody to endotoxin. Serum protein levels, especially in the γ-globulin fraction, are increased. Antibody response to sheep RBC, ovalbumin and reovirus type 3 are enhanced. There is an earlier onset and increased incidence of anti-smooth-muscle antibody compared to controls. The basic picture is of progressive liver disease accompanied by immunologic abnormality without the demonstration of virus. Affected mice show thymic atrophy, runting and an increased incidence of reticuloendothelial neoplasm. It is concluded that the value of the murine model lies in both the close clinical and laboratory similarities of the human and murine conditions, and also in the natural route of infection used and the rarity of development of the chronic condition.

6863 PREVENTION OF ALCOHOL-INDUCED FATTY LIVER BY NATURAL METABOLITES AND RIBOFLAVIN. *(E.)* Stanko, R. T.; Adibi, S. A. (Montefiore Hosp., Pittsburgh, Pa.). *Gastroenterology* 68(4):990, 1975.

6864 BILE ACIDS REGULATE INTESTINAL CELL TURNOVER. *(E.)* Raicht, R. F.; Deschner, E.; Salen, G. (VA Hosp., East Orange, N.J.). *Gastroenterology* 68(4):979, 1975.

6865 THE EFFECT OF INSULIN AND GLUCAGON ON HEPATIC BILE FLOW IN EX-VIVO PERFUSED PORCINE AND CANINE LIVER. *(E.)* Ruwart, M. J.; Kaminski, D. L.; Willman, V. L. (St. Louis Univ., St. Louis, Missouri). *Gastroenterology* 68(4):977, 1975.

6866 REGENERATION IN THE CARBON TETRACHLORIDE INJURED RAT LIVER. *(E.)* Rosenkranz, E.; Charters, A. C.; Orloff, M. J. (Sch. Med., Univ. California, San Diego, Calif.). *Gastroenterology* 68(4):976, 1975.

6867 THE EFFECTS OF CHLORPROMAZINE HYDROCHLORIDE (CPZ) ON BILE FORMATION AND BILIARY SECRETION IN THE PRIMATE. *(E.)* Ros, E. R.; Small, D. M.; Carey, M. C. (Boston Univ. Sch. Med., Boston, Mass.). *Gastroenterology* 68(4):975, 1975.

6868 COMPARISON OF GASTRIN AND OCTAPEPTIDE-CCK BINDING AND TENSION DEVELOPMENT IN CAT GALLBLADDERS. *(E.)* Praissman, M.; Chowdhury, R.; Fara, J.; Berkowitz, J. M. (Nassau County Med. Cent., East Meadow, N.Y.). *Gastroenterology* 68(4):968, 1975.

6869 CHARACTERIZATION OF CLOSTRIDIAL CHOLANOYL-AMINO ACID HYDROLASE. *(E.)* Patnaik, R. N.; Sokolow, M.; Vocci, M.; Nair, P. P. (Sinai Hosp., Baltimore, Md.). *Gastroenterology* 68(4):966, 1975.

6870 DEPRESSION OF MICROSOMAL ACTIVITY IN THE LIVER OF MICE FOLLOWING SINGLE ADMINISTRATION OF HALOTHANE AND ITS INFLUENCIBILITY BY SILYBIN. *(Ger.)* Janiak, B. (Inst. Anaesthesiologie, Univ. Mainz, Germany). *Anaesthesist* 23(9):389-393, 1974.

6871 PECULIARITIES OF MICROCIRCULATION IN THE LIVER IN ANAPHYLACTIC SHOCK. *(Rus.)* Ovsyannikov, V. G.; Vashetina, S. M. (Rostov Medical Inst., Rostov, USSR). *Biull. Eksp. Biol. Med.* 79(3):79-82, 1975.

6872 THE EFFECTS OF MESENTERICOCAVAL SHUNTS ON MITOCHONDRIAL METABOLISM AND FUNCTION IN THE RAT LIVER. *(It.)* Ursini, F.; Vincenti, E.; Ferri, L. M.; Bertaini, G.; Gregolin, C.; Vassanelli, P.; Stella, G. D.; Pelizzo, M. R.; Rizzi, B. (Istituto Chimica Biologica, Padova, Italy). *Arch. Sci. Med.* 131(4):206-210, 1974.

6873 CYANOSIS OF HEPATIC ORIGIN: VALUES OF PARTIAL PRESSURE OF OXYGEN IN ARTERIAL BLOOD DURING EXPERIMENTAL CIRRHOSIS IN RABBITS. *(Cz.)* Radzikowski, A.; Milanowski, A.; Zalewski, T.; Aleksandrowicz, R. (Academy Medicine, ul. Dzialdowska 1/3, 01-184 Warsaw, Poland). *Pediatr. Pol.* 49(9): 1081-1087, 1974.

6874 LIVER TRANSPLANTATION IN THE RAT: NOTE ON TECHNIQUE AND STATISTICAL EVALUATION OF SOME ENZYME ACTIVITIES IN THE ABSENCE OF IMMUNOSUPPRESSIVE THERAPY. *(It.)* Ronzoni, G.; Pagliari, G.; Grassetti, F.; Ngalikpima, V.; Alma, R.; Nenna, E. (Clinica Medica, Universita Cattolica, Rome, Italy). *Chir. Patol. Sper.* 21(1):1-21, 1973.

6875 EXPERIMENTAL CONTRIBUTION TO THE PROBLEM OF SURGICAL STIMULATION OF LIVER REGENERATION. *(Cz.)* Cerny, J.; Geryk, B. (Dept. Surgery, OUNZ, Zilina, Czechoslovakia). *Bratisl. Lek. Listy* 61(1):38-41, 1974.

6876 EFFECT OF THE RHYTHM OF EXPOSURE TO A HARMFUL AGENT ON THE NATURE OF REPARATIVE REGENERATION OF THE LIVER. *(Rus.)* Sarkisov, D. S.; Paltsin, A. A.; Popova, I. V. Badilovu, A. K.; Vtyurin, B. V. (I. M. Sechenov 1st Moscow Medical Inst., Moscow, USSR). *Arkh. Patol.* 37(1):80-87, 1975.

6877 BIOCHEMICAL AND ULTRASTRUCTURAL FINDINGS ON THE LIVERS OF RATS TREATED WITH ENFLURANE. *(It.)* Gasparetto, A.; Manani, G.; Martines, G.; Grappa, M. T.; Scalella, P. (Cattedra Anestesiologia e Rianimazione, Universita Study, Padua, Italy). *Acta Anaesthesiol. Ital.* 25(suppl):141-167, 1974.

6878 BILE PROTEINS AND THEIR ROLE IN GALLSTONE FORMATION. *(Jpn.)* Katsuki, T.; Ijuin, K.; Kawamura, H. (Kagoshima Univ. Faculty Medicine, Kagoshima, Japan). *Igaku Kenkya* 44(2):90-103, 1974.

6879 PROSTHETIC REPLACEMENT OF THE COMMON BILE DUCT: EVALUATION OF HEPATOBILIARY FUNCTION AFTER PROSTHETIC REPLACEMENT OF THE COMMON BILE DUCT IN THE DOG. *(It.)* Ronzoni, G.; Grassetti, F.; Butti, A.; Doglietto, G. B.; Maria, G.; Maria, G.; Pescatori, M.; Pagliari, G.; Colagrande, C. (Clinica Medica, Universita Cattolica, Rome, Italy). *Chir. Patol. Sper.* 22(3):155-172, 1974.

6880 PHALLOIDIN ANTAGONISTS: PROTECTIVE EFFECT OF DISILYBIN IN PHALLOIDIN-DAMAGED HEPATOCYTES. *(Ger.)* Petzinger, E.; Homann, J.; Frimmer, M. (Fachbereich Veterinarmedizin, Justus-Liebig Universitat, Giessen, Germany). *Arzneim. Forsch.* 25(4):571-576, 1975.

6881 A COMPARISON OF THE INDUCTIVE EFFECTS OF PHENOBARBITAL, METHAQUALONE, AND METHYPRYLON ON HEPATIC MIXED FUNCTION OXIDASE ENZYMES IN THE RAT. *(E.)* Reinke, L. A.; O'Connor, M. F.; Piepho, R. W.; Stohs, S. J. (Univ. Nebraska Medical Center, Lincoln, Neb.). *Res. Commun. Chem. Pathol. Pharmacol.* 11(1):45-53, 1975.

6882 AGE DIFFERENCES AFFECTING INDUCTION OF HEPATIC DRUG METABOLIZING ENZYMES BY METHAQUALONE AND PHENOBARBITAL IN THE RAT. *(E.)* Mathur, P. P.; Boren, J. A.; Smyth, R. D.; Reavey Cantwell, N. H. (William H. Rorer, Inc., Res. Div., Fort Washington, Pa. 19034). *Res. Commun. Chem. Pathol. Pharmacol.* 11(1):39-44, 1975.

6883 ALTERATIONS OF RAT LIVER LYSOSOMES AND SMOOTH ENDOPLASMIC RETICULUM INDUCED BY THE DIAZAFLUORANTHEN DERIVATIVE AC-3579. III. MECHANISM AND SITE OF ACTION. *(E.)* Laurent, G.; Hildebrand, J.; Thys, O. (Tumor Cent., Univ. Libre, Brussels, Belgium). *Lab. Invest.* 32(5):580-584, 1975.

6884 DIETARY AND HORMONAL EFFECTS UPON ACTIVITY OF "SOLUBLE" PROTEIN AND PARTICULATE FRACTION OF FATTY ACID DESATURATION SYSTEM OF RAT LIVER MICROSOMES. *(E.)* Nervi, A. M.; Catala, A.; Brenner, R. R.; Peluffo, R. O. (Inst. Physiol., Univ. Nacional, La Plata, Argentina). *Lipids* 10(6):348-352, 1975.

6885 ADAPTIVE CHANGES IN Δ9 DESATURASE ACTIVITY IN RAT LIVER. *(E.)* De Tomas, M. E.; Mercuri, O.; Peluffo, R. (Facultad de Ciencias Medicas, La Plata, Argentina). *Lipids* 10(6):360-362, 1975.

6886 EFFECT OF $PGE_1$ ON GLUCONEOGENESIS AND GLYCEROL ESTERIFICATION IN PERFUSED LIVER OF FASTED RATS. *(E.)* Imesch, E.; Rous, S. (Univ. Genena, Sch. Med., 1211 Geneva 4, Switzerland). *Prostaglandins* 9(6):945-957, 1975.

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6923 INFLUENCE OF LAENNEC ON $CCl_4$-INJURED LIVER, PARTICULARLY ITS EFFECT ON LIVER CIRRHOSIS. *(Jpn.)* Sakamoto, K.; Kasahara, T.; Hayashi, M.; Nishimura, T. (Tokyo Med. Coll., Japan). *J. Tokyo Med. Coll.* 32(2):351-363, 1974.

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6925 PENTOBARBITAL INHIBITS THE BILIARY EXCRETION OF ORGANIC ACIDS: A STUDY WITH SUCCINYLSULFATHIAZOLE IN THE RAT. *(E.)* Bailey, D. G.; Paul, H.; Johnson, G. E. (Dep. Pharmacol., Univ. Toronto, Canada). *Can. J. Physiol. Pharmacol.* 53(3): 470-474, 1975.

6926 METABOLISM OF BILE ACIDS. I. ABSORBTION, DISTRIBUTION, EXCRETION, AND METABOLISM OF URSODEOXYCHOLIC ACID. *(Jpn.)* Hoshita, T.; Kono, M.; Matsumoto, M.; Uchiyama, M.; Kuramoto, T. (Hiroshima Univ. Sch. Med., Japan). *J. Pharm. Soc. Jpn.* 94(10):1196-1205, 1974.

See also, 6604, 6630, 6712, 6819, 6955, 7575, 7629, 7815.

## SECRETION AND METABOLISM

### Intestine

6927 A NON-DESTRUCTIVE METHOD FOR MEASURING INTESTINAL CELL TRANSIT TIME. *(Eng.)* Hagemann, R. F.; Cooper, J.; Poulakos, L. (Allegheny General Hosp., 320 E. North Ave., Pittsburgh, Pa. 15212). *Cell Tissue Kinet.* 8(4): 391-396, 1975.

A method is described for measuring intestinal cell transit time using the time of labeling of S phase crypt cells as the 'start' measurement and the time of lumenal digestion of these cells as the 'finish' measurement. Ha/ICR mice were injected with methimazole (1 mg, i.p.); 25 min later they were given sodium thiocyanate (0.05 mg) and 5 min later were given $^{125}$I-iododeoxyuridine ($^{125}$I-UdR) (3 µCi). Methimazole was injected every 2 hr for 12 hr thereafter. Male Holtzman rats (5 mg methimazole, 4 µCi, $^{125}$I-UdR), adult male gerbils (2 µCi $^{125}$I-UdR), and adult beagle dogs (10 mg methimazole, i.v. every 3 hr, 10 µCi $^{125}$I-UdR) were treated according to similar procedures. During methimazole administration, the animals' drinking water contained chlorothiazide (1 mg/ml), a diuretic. At various intervals beginning 24 hr after $^{125}$I-UdR, the thyroid and jejunum were counted in a liquid scintillation spectrometer. In the rats, gerbils and mice, for which the intestinal cell transit times are known, the loss of intestinal radioactivity by cell loss from the villi was accompanied by a prompt rise in thyroidal activity. The transit times thus obtained corresponded to the previously established cell transit times in these animals (i.e., 42-46 hr in mice, 38-42 hr in rats, and 120-130 hr in gerbils). The net thyroid activity plots in the dogs, a species in which the transit time values are unknown, indicated an intestinal cell transit time of about 32 to 37 hr. Thus, the mammalian thyroid gland can be used as an *in situ* biological indicator for determining intestinal cell transit time without a requirement for tissue sampling.

6928 QUANTIFICATION OF PHYSIOLOGICAL CHANGES IN GUT ENDOCRINE CELLS: IMMUNOCYTOCHEMICAL AND RADIOIMMUNOASSAYS OF SECRETIN CELL FUNCTION. *(E.)* Polak, J. M. Pearse, A. G. E.; Bloom, S. R.; Joffe, S. N. (Hammersmith Hosp., London, England). *Acta Hepato-Gastroenterol. (Stuttg.)* 22(3):186-189, 1975.

Instrumentation and technology for random sampling of mucosal specimens were developed and are illustrated in five English White pigs by the response of the secretin cells to the instillation of acid into the duodenal mucosa. Acid (0.1 N HCl) was perfused at a constant rate through the duodenum and jejunum which were isolated and cannulated. Eight identical samples of mucosa were freeze dried and fixed in diethylpryrocarbonate vapor and subsequently embedded in paraffin wax. Sections of tissue were cut and subjected to indirect immunocytochemistry using peroxidase labeling; quantification was made using a Television Image conversion analyzer. In an illustration of a representative section of resting duodenal mucosa, six secretin cells are enclosed in circles which contain a heavy black brown deposit of the diaminobenzidine (DAB) polymer which is the final reaction product. In contrast, in a section of mucosa taken after 30 min perfusion with acid, there were five secretin cells which contained DAB polymer in much lesser amount. The mean fall in secretin levels calculated from the results of image analysis amount to 52% as compared to 72% from parallel radioimmunoassays. It is concluded that secretin is released in response to the presence of acid in the

duodenum and that the results of immunocytochemical techniques can be quantified by image analysis to provide meaningful data for the interpretation of physiological changes in gut endocrine cells.

6929 THE PANETH CELL: A SOURCE OF INTESTINAL LYSOZYME. *(E.)* Peeters, T.; Vantrappen, G. (Laboratorium voor gastrointestinale fysiopathologie, Katholieke Universiteit te Leuven, Belgium). *Gut* 16(7):553-558, 1975.

The presence of lysozyme as a Paneth cell secretory product was studied in the mouse. Small intestine was quickly removed from mice, frozen, and fixed in ethanol. Slices were covered with rabbit antilysozyme antiserum, washed and covered with fluorescent antirabbit immunoglobulin, and examined by fluorescence microscopy. For a separate perfusion study, NMRI mice had the jejunum incised 4 cm and 24 cm distal to the pyloric sphincter, and the 20 cm jejunal segment was perfused with saline at 4.0 ml/hr. The outlet was connected to a fraction collector. Each 1 ml fraction collected corresponded to 15 min of perfusion time. Pilocarpine was injected i.v. after a control period, and the perfusate was assayed turbidometrically for lysozyme. Amylase activity was also determined. Fluorescence microscopy showed a positive reaction in the Paneth cell region of the crypts. Faint fluorescence was seen in other mucous membrane cells. Fluorescence was absent when antilysozyme antiserum was replaced by normal rabbit serum, or when the antiserum was pre-incubated with the pure antigen. Injection of 4 mg of pilocarpine five min before dissection resulted in the disappearance of all crypt fluorescence, while a stream of fluorescence appeared between the villi. After 10 min, a granular fluorescent material was found on top of the villi. The perfusion studies showed initial high amylase levels which decreased over 2.5 hr to a low basal value. Lysozyme started out at a low basal value and remained stable. Pilocarpine injection caused a sharp rise in lysozyme level from the basal value (0.06-0.27 µg/ml) to 3.9 µg/ml, but amylase level was unaffected. Lysozyme concentrations were lower in starved animals (0.16 µg/ml) than in unstarved animals (0.31 µg/ml). It is concluded that lysozyme is present in and secreted by the Paneth cells, and can serve as a marker of Paneth cell function.

6930 OXIDATION-REDUCTION POTENTIALS IN THE CECAL CONTENTS OF RATS AND MICE. *(E.)* Koopman, J. P.; Janssen, F. G. J.; van Druten, J. A. M. (Central Animal Lab., Catholic Univ., Nijmegen, Netherlands). *Proc. Soc. Exp. Biol. Med.* 149(4): 995-999, 1975.

The oxidation-reduction potential (ORP) in the cecal contents of conventional adult Wistar rats, Swiss $ND_2$ germ-free mice, and mice with a Colonization Resistance Factor flora (CRF-mice) was investigated. By using animals that were anesthetized (by α-chloralose) for a longer period of time, the authors attempted to eliminate the disturbing influence of oxygen. In addition, measurements were made under anaerobic conditions. For the rats, the ORP values reached a more or less constant level after about 30 min following the insertion of the electrodes in the cecum. The mean ORP at that time was -458 mV (SD = 45 mV). The mean ORP values for the mice showed a more gradual reduction than was found in the rats. The curves leveled off at about 100 min following the insertion of the electrodes. The mean ORP values 100 min after electrode insertion were: germ-free mice, +3mV (SD = 39 mV); CRF-mice, -554 mV (SD = 20 mV). In rats, the ORP value decreased after death; no decrease was observed in mice. No difference was found in the values obtained when measuring under aerobic or anaerobic conditions after death. The ORP values found in the present study are within the range of those found earlier in the artificial media used for the cultivation of strict anaerobes from the cecum of mice. The present study indicates that the ORP is at the same level *in vivo* and *in vitro*; consequently, it is likely that the cultivation of anaerobic bacteria *in vitro* as described in an earlier report is not negatively influenced by the ORP level.

6931 SUBSTRATE UTILIZATION AND OXYGEN CONSUMPTION BY CANINE JEJUNAL MUCOSA IN VITRO. *(E.)* Lester, R. G.; Grim, E. (Dept. Physiology, Univ. Minnesota, Minneapolis 55455). *Am. J. Physiol.* 229(1):139-143, 1975.

Some aspects of canine jejunal mucosal metabolism of endogenous and exogenous substrates are described. Oxygen consumption, carbon dioxide production and substrate utilization in small pieces of jejunal mucosa removed from mongrel dogs were measured in standard Warburg respirometers. Experiments were performed with tissues from three dogs in which no exogenous substrate was added to the incubation flasks. The preparation typically continued to respire until the study was discontinued at 4 hr, the rate being relatively stable for 1 hr, after which there was slow decline to a final value which was about 2/3 the initial value. Regular cyclic fluctuations were present, with a period of 35 to 40 min and an amplitude of 30 to 40% of the mean value. Oxygen consumption was 0.21 µM/hr/mg, dry weight, and the respiratory quotient was 0.73. Addition of $^{14}C$-labeled glucose or galactose (200 mg/100 ml) increased both oxygen consumption (0.33 and 0.28 µM/hr/mg, dry weight, resp.) and the respiratory quotient 0.90 and 0.83, resp.). Endogenous substrate metabolism was decreased by [$^{14}C$] fructose (200 mg/100 ml), but not by glucose or galactose. Less than 15% of the metabolized glucose and fructose was degraded to $CO_2$. Of the metabolized glucose, 80% was recovered as lactate. Galactose disappeared at 1/7 the rate of glucose, but 40% of that metabolized was degraded to $CO_2$. It is suggested that the cycles observed in all experiments were due to an *in vivo* tissue mechanism.

6932 ENZYME PATTERNS AND PROTEIN ABSORPTION IN RAT COLON DURING DEVELOPMENT. *(E.)* Helander, H. F. (Dept. Anatomy, Univ. Umea, Sweden). *Acta Anat.* 91(3):330-349, 1975.

The functional development of the rat colonic mucosa reflected in the contents of carbonic anhydrase, β-D-

galactosidase, and acid and alkaline phosphatase was studied. Carbonic anhydrase activity reached a peak in 10-day-old rats which was about seven times the activity in the newborn rat. A peak value for β-D-galactosidase was detected 1 day after birth. Alkaline phosphatase displayed a pattern similar to that of β-D-galactosidase. The activity of acid phosphatase showed a flat curve with a poorly marked maximum at 5-10 days of age. A fairly weak staining reaction for carbonic anhydrase was found mainly at the surface of the mucosa during peak activity. A similar reaction held for β-D-galactosidase. Alkaline phosphatase activity was generally confined to the brush border, the lateral cell borders, close to the walls of vesicles in or subjacent to the terminal web region and in 0.5 to 2.0 μm large rounded bodies in the supranuclear cytoplasm. Most of the acid phosphatase activity was concentrated in the supranuclear bodies. Milk peroxidase and insulin enemas were absorbed in the infant rat colon, but this capacity was much reduced after weaning. It is suggested that the colonic mucosa may have a different function in the infant than in the adult.

6933 DIFFERENTIATION AND MATURATION OF CULTURED FETAL RAT JEJUNUM. *(E.)* DeRitis, G.; Falchuk, Z. M.; Trier, J. S. (Harvard Medical Sch., Boston, Mass. 02115). *Dev. Biol.* 45(2):304-317, 1975.

To determine whether differentiation and maturation of mammalian intestinal mucosa require factors available only *in vivo* or factors available both *in vivo* and *in vitro*, jejunum from fetal (18th day of gestation) Sprague-Dawley rats was cultured in chemically defined medium using organ culture methodology. Jejunal segments were cultured in modified Leibowitz L-15 medium in room air at 37 C for 24, 48, or 72 hr, after which they were examined by light and electron microscopy. Uncultured jejunum had either no or very few rudimentary villi and was lined largely by undifferentiated stratified epithelium. Goblet cells were not seen. In contrast, villi were present in most of the 24-hr cultures, and simple columnar rather than stratified epithelium predominated. After 48 and 72 hr, villi were present in over 90% of the cultured segments and the stratified epithelium had disappeared. Goblet cells were seen in jejunal segments cultured 48 hr or longer in 47 of 74 fetuses. Electron microscopy further documented the progressive differentiation of the epithelium during culture. Microvilli increased in number and height, a terminal web developed in the apical cytoplasm, and the number of apical vesicles, mitochondria, and formed elements of endoplasmic reticulum increased in the absorptive cells. Jejunal lactase and alkaline phosphatase activity increased 9- and 7-fold, resp., during 72 hr of culture, while the activity of the mitochondrial enzyme ornithine carbamoyl transferase increased 4-fold. The data indicate that jejunum from 18-day fetal rats can be cultured *in vitro* for at least 72 hr in chemically defined medium and that, during culture, maturation of the jejunal mucosa takes place with the appearance of villi, conversion of stratified to columnar epithelium, and differentiation of individual epithelial cells.

6934 HUMAN INTESTINAL SUCRASE-ISOMALTASE. IDENTIFICATION OF FREE SUCRASE AND ISOMALTASE AND CLEAVAGE OF THE HYBRID INTO ACTIVE DISTINCT SUBUNITS. *(Eng.)* Conklin, K. A.; Yamashiro, K. M.; Gray, G. M. (Stanford Univ. Sch. Medicine, Stanford, Calif. 94305). *J. Biol. Chem.* 250(15):5735-5741, 1975.

The interrelation of the hybrid sucrase-isomaltase complex and its active sucrase and isomaltase subunits in homogenates of human small intestine (obtained at autopsy 1-16 hr after death) was examined. The complex and its functional subunits were identified by Sephadex 6-200 (superfine) chromatography aided by isomaltase moiety affinity for dextran gel; this moiety bound strongly to the gel at 4 C, requiring two column volumes for elution. Bio-Gel P-300 chromatography, density gradient (100,000 to 300,000 x *g* at 4 C for 4-6 hr), and equilibrium centrifugation (300,000 x *g* for 72 hr and 97 hr at 4 C) demonstrated that the sucrase subunit and the isomaltase subunit are similar, but unequal in size (Stokes radius = 45, 43 Å; frictional ratio = 1.32, 1.30; $S_{20,w}$ = 6.9, 6.6; MW = 130,000, 120,000 resp.). The sucrase-isomaltase complex (Stokes ratio = 70 Å, frictional ratio = 1.61, $S_{20,w}$ = 9.8, MW = 280,000) appeared as an elongated hybrid molecule and was less symmetrical than the subunits. Apparent $K_m$ and pH activity curves were indistinguishable for each enzyme in the hybrid of the free state. The complex accounted for 90% of the intestinal sucrase and isomaltase activities and was isolated and cleaved by 0.01 M β-mercaptoethanol/6 M urea treatment into subunits which have identical biochemical characteristics with the free sucrase and isomaltase moieties. Sodium dodecyl sulfate acrylamide gel electrophoresis also produced subunits with molecular weights very close to those for active free sucrase and isomaltase moieties, indicating that each α-glucosidase consisted of a single polypeptide chain. Immunization of rabbits with pure sucrase-isomaltase complex yielded a monospecific precipitating antibody which reacted with the hybrid and the sucrase moiety, but which showed minimal affinity for the isomaltase subunit; this provides further evidence that the sucrase-isomaltase molecule is a hybrid consisting of two distinct α-glucosidases. It is also suggested that the two nonidentical subunits act independently on their respective substrates.

6935 INTRACELLULAR DISTRIBUTION OF β-GALACTOSIDASES IN MUCOSAL CELLS FROM HOG SMALL INTESTINE. *(E.)* Sato, M.; Yamashina, I. (Faculty Pharmaceutical Sci., Kyoto Univ., Japan). *Biochim. Biophys. Acta* 397(1):179-187, 1975.

The intracellular distribution of three β-galactosidases (hetero β-galactosidase, lactase, and acid β-galactosidase) in the hog small intestinal mucosa was studied. The mucosa was homogenized and separated into five subcellular fractions (I-V) by differential centrifugation. Purified brush borders and mucosal lysosomes were also prepared. The β-galactosidases were identified by hydroxylapatite column chromatography, and the various preparations were assayed for hetero β-galactosidase, lactase,

sucrase, acid and alkaline phosphatases, glucose-6-phosphatase, NADPH-cytochrome c reductase, and cytochrome oxidase. Sucrase activities were higher in fractions III (lysosomal fraction) and IV (microsomal fraction) than in fraction I (nuclei and brush borders). Fraction III also contained significant amounts of microsomes, microvilli, and mitochondria, fraction II consisted mainly of mitochondria, and fraction IV contained microsomes, microvilli, and lysosomes. Lactase activity essentially paralleled the distribution of sucrose activity in the subcellular fractions, and most of the hetero β-galactosidase activity was found in fraction V (cytosol fraction). Some lactase and acid β-galactosidase activities were also found in the cytosol fractions. Sucrase activity was high in the purified brush borders, the lactase activity in this preparation being about 7-fold greater than in the homogenate and the hetero and acid β-galactosidase activities being lower than in the homogenate. The ratios of hetero β-galactosidase and acid β-galactosidase to lactase in the brush border preparations were 1:3.6 and 1:0.11, respectively. The lysosomal preparations contained low lactase and hetero β-galactosidase activities and high levels of acid β-galactosidase activity. It is concluded that acid β-galactosidase is a lysosomal enzyme and that lactase is localized in the brush borders.

6936 ADENYLATE AND GUANYLATE CYCLASE ACTIVITIES AND CELLULAR DIFFERENTIATION IN RAT SMALL INTESTINE. *(E.)* Quill, H.; Weiser, M. M. (Harvard Medical Sch., Boston, Mass.). *Gastroenterology* 69(2):470-478, 1975.

Nucleotide cyclase levels and cyclic nucleotide phosphodiesterase activities were measured in the small intestinal villus and crypt cells of nonfasted female Holtzmann rats to determine possible correlations with cellular differentiation and subcellular localization. The intestinal epithelial cells were isolated into villus and crypt gradients by the method of Weiser. The different preparations were homogenized and the supernatant fractions were assayed for adenylate cyclase, guanylate cyclase, phosphodiesterase, and sucrase. The guanylate cyclase activity in the crypt cells was significantly lower than in the villus cells, the reverse being true for adenylate cyclase. There was no gradient activity for cyclic guanosine 3':5'-monophosphate phosphodiesterase, although cyclic AMP phosphodiesterase activity was lower in the villus cells than in the crypt cells. No villus to crypt gradient of cyclic AMP activity was detected in intestinal mucosa frozen rapidly in liquid nitrogen. When isolated villus cells were homogenized and fractionated by differential centrifugation, the highest specific activity of both adenylate and guanylate cyclase was in the 20,000 *g* pellet. A small amount of adenylate cyclase, but no guanylate cyclase, activity was found in the soluble fraction. The ($Na^+$, $K^+$)-ATPase-rich lateral-basal membrane fraction isolated from the 20,000 *g* pellet by sucrose gradient centrifugation showed a 5-fold greater specific activity for adenylate cyclase than was found in the homogenate; the guanylate cyclase activity of the membrane fraction was lower than in the homogenate. The specific activity of guanylate cyclase increased 5-fold with purification of the microvillus membranes (isolated from homogenates of mucosal scrapings), but this preparation had no detectable adenylate cyclase activity. Preparations of isolated nuclei contained no detectable adenylate cyclase activity and the nuclear guanylate cyclase activity was decreased in comparison with the homogenate. The data suggest that guanylate cyclase has a specialized role in the differentiated villus cell and that the cyclases may be interrelated, possibly reflecting the epithelial cell polarity for absorption and secretion.

6937 THE NUTRITIVE EFFECT OF GLUCOSE ON THE STRUCTURE AND FUNCTION OF JEJUNAL SELF-EMPTYING BLIND LOOPS IN THE RAT. *(E.)* Menge, H.; Werner, H.; Lorenz-Meyer, H.; Riecken, E. O. (Medizinsche Universitats-Klinik, Marburg-an-der-Lahn, West Germany). *Gut* 16(6):462-467, 1975.

The effects of glucose, galactose and Ringer's solution on the development of mucosal structure and function were studied in jejunal self-emptying blind loops. Female Wistar rats were provided with a blind loop from the proximal jejunum. Beginning 5 days after operation, the animals were infused with 3 ml of the infusate three times/day for 27 days. Group I received an isotonic glucose (36.5 g/l) and NaCl (3.0 g/l) solution (nine rats) or Ringer's solution (control; nine). Group II received an isotonic galactose (36.5 g/l) and NaCl (3.0 g/l) solution (nine) and Ringer's (controls; nine). The blind loops were excised for histological examination and morphometric evaluation on day 32. Only rats infused with galactose lost weight during the first 4 days after operation. There was no difference in weight between any of the groups after this. There was a significant increase in villus height with infusion of glucose; the villus height to crypt length ratio was also increased. Maltase activity showed a marked rise with glucose infusion (47.3 U/g protein compared with control, 38.5 U/g protein). A reduction in peptidase activity was also observed with glucose. Infusion of galactose tended to lower dipeptidase levels. Glucose absorption was enhanced in loops perfused with both glucose and galactose, although the effect of galactose (2.07 mg/cm of intestine/hr) was not as great as that of glucose (2.23 mg/cm of intestine/hr). These results indicate an apparent increase in the number of transport sites for monosaccharides, which is induced by the presence of a substrate (glucose or galactose) within the experimental loop.

6938 THE INFLUENCE OF FOOD INTAKE ON THE DEVELOPMENT OF STRUCTURAL AND FUNCTIONAL ADAPTATION FOLLOWING ILEAL RESECTION IN THE RAT. *(E.)* Menge, H.; Grafe, M.; Lorenz-Meyer, H.; Riecken, E. O. (Medizinische Universitats-Klinik, Marburg-an-der-Lahn, West Germany). *Gut* 16(6):468-472, 1975.

The influence of food consumption on adaptive changes in the intestinal mucosa was studied following ileal resection, under pair-fed and free-fed conditions. Female Wistar rats (14) underwent ileal resection and end-to-end anastomosis; another nine rats were

sham-operated. For 3 days after surgery, the rats were fed with a sugar salt solution. Following this, nine of the ileal-resected rats were pair-fed and the remaining five were allowed food *ad libitum*. The pair-fed, ileal-resected rats had significantly lower body weights than either the sham-operated controls or the free-fed ileal-resected rats. There was no difference in the mucosal structure of controls and pair-fed ileal-resected rats. The free-fed group, however, had hypertrophic mucosae, with taller and wider villi, deeper crypts, larger epithelial cells and thicker muscular layers. Both glucose absorption and the glycyl-L-leucine activity were significantly increased in pair-fed and free-fed, ileal-resected rats. These data confirm the absence of changes at the cellular level, indicating that the stimulation of absorptive capacity results from an increase in the number of absorbing cells, rather than from an augmentation in the activity of individual cells.

6939 PROTEIN AND GLYCEROLIPID BIOSYNTHESIS IN ISOLATED EPITHELIAL CELLS OF NORMAL AND BILE-FISTULA RATS. *(E.)* O'Doherty, P. J. A.; Yousef, I. M.; Kakis, G.; Kuksis, A. (Dept. Biochemistry, Univ. Toronto, Canada M5G 1L6). *Arch. Biochem. Biophys.* 169(1):252-261, 1975.

Alterations in biochemical transformations accompanying the deprivation of lysophosphatidylcholine or choline in isolated intestinal epithelial cells were studied. Fat-filled cells were prepared from normal and 1-day bile-fistula rats. Protein synthesis from [1-$^{14}$C]leucine (2 μCi) was decreased 40 to 45% in cells from bile-fistula rats, and glycoprotein synthesis from [1-$^{14}$C]glucosamine (1 μCi), 25 to 30%. The synthesis of phosphatidylcholine from a variety of precursors was decreased 40 to 45% while no change was seen in the formation of either phosphatidylethanolamine or triacylglycerols. Chylomicron release was inhibited 70-80% in bile-fistula cells. *In vitro* addition of either lysophosphatidylcholine or choline (6-10 μM or higher, resp.) to bile-fistula cells resulted in greatly increased phosphatidylcholine and protein biosynthesis and an effective release of chylomicrons. It is suggested that biliary diversion may effectively starve the intestinal cells of choline, resulting in decreased phosphatidylcholine biosynthesis, which in turn causes decreased protein synthesis and incorporation into chylomicrons.

6940 EFFECT OF PUROMYCIN IN VITRO ON PROTEIN AND GLYCEROLIPID BIOSYNTHESIS IN ISOLATED EPITHELIAL CELLS OF RAT INTESTINE. *(E.)* O'Doherty, P. J. A.; Kuksis, A. (Dept. Biochemistry, Univ. Toronto, Ontario, Canada M5G 1L6). *Int. J. Biochem.* 6(6):435-441, 1975.

The early events accompanying puromycin poisoning of isolated intestinal absorptive cells *in vitro* were studied. Fat-filled mucosal absorptive cells were prepared from male Wistar rats. Analysis of the incorporation of [$^{14}$C]leucine (20 mCi/mM) into the total protein of intestinal epithelial cells showed a linear increase in uptake over the first 30 min for controls, after which uptake levelled off. The addition of long puromycin led to an 85 to 90% inhibition of protein synthesis at 1 hr. Addition of puromycin caused little inhibition of [$^{14}$C]glucosamine (30 mCi/mM) uptake in hr 1, and only a 10 to 20% decrease by hr 2. Addition of puromycin caused a 30 to 40% inhibition of chylomicron secretion. Triacylglycerol synthesis from [2-$^{3}$H]glycerol (200 mCi/mM) was not affected. Phosphatidylcholine showed a 35% inhibition by the end of hr 2. Addition of puromycin produced no change in the triacylglycerols of the cells or chylomicrons, while the specific activity of the phosphatidylcholines decreased. Addition of puromycin had no effect on the incorporation of 2-hexadecyl-[2-$^{3}$H]-glycerol (3.5 x $10^3$ μCi/μM) into 1,3-diacyl-2-alkyl-*sn*-glycerols. Incorporation of 1-acyl-*sn*-[2-$^{3}$H]glycerol-3 phosphorylcholine (130,000 dpm/μM) into phosphatidylcholine was only inhibited 20 to 25%. It is concluded that the effect of puromycin is due to its interference with the normal biogenesis of the endoplasmic reticulum, which involves both protein and phospholipid biosynthesis.

6941 THE POSSIBLE ROLE OF PANCREATIC PROTEASES IN THE TURNOVER OF INTESTINAL BRUSH BORDER PROTEINS. *(E.)* Alpers, D. H.; Tedesco, F. J. (Washington Univ. Sch. Medicine, St. Louis, Mo. 63110). *Biochim. Biophys. Acta* 401(1):28-40, 1975.

The possible effect of pancreatic proteases on the turnover of intestinal brush border enzymes was examined in nine male Wistar rats subjected to 95% pancreatectomy. At time of sacrifice three to six months later, four animals were considered to have recovered pancreatic function; all four had a vitamin B12 absorption greater than 50% which did not increase with the addition of trypsin. In addition, the proteolytic activity of their intestinal juice was comparable to that of nonoperated control rats. The remaining five animals were judged to have pancreatic insufficiency and especially protease deficiency. Enzyme studies on homogenates of the proximal third of the small intestine revealed a 50% increase in specific lactase, sucrase, and maltase activities in all nine animals. Protein turnover was measured *in vivo* using double labeling with [$^{3}$H]- and [$^{14}$C] valine. Proteins with apparent molecular weights of about 200,000-270,000 turned over more rapidly than small proteins. The $^{3}$H/$^{14}$C ratio ranged from 4.7 to 6.2 in animals without pancreatic insufficiency and from 2.3-3.1 in those with decreased pancreatic proteolysis. Estimates of relative synthetic rates of large brush border proteins were lower than normal in pancreatectomized animals, but were constant over the period of the labeling experiment. *In vitro*, using purified brush borders, unfractionated pancreatic enzymes removed sucrase, maltase and lactase, but not alkaline phosphatase and trehalase. A model is thus proposed for the normal catabolism of some large intestinal brush border proteins. It is suggested that the surface of intestinal absorptive cells is being constantly remodeled, and that certain surface enzymes are in part removed from the membrane by the action of pancreatic proteases.

6942 THE EFFECT OF DUODENAL JUICE ON THE INTRINSIC FACTOR (IF) ACTIVITY IN GASTRIC JUICE. *(E.)* Vatn, M. H. (Ulleval Hosp., Oslo 1, Norway). *Scand. J. Gastroenterol.* 10(1):49-53, 1975.

The effect of duodenal juice on intrinsic factor (IF) activity in gastric juice during basal conditions and during stimulation with gastrointestinal hormones was studied to evaluate the effect of refluxed duodenal juice on IF measurements. Gastric and duodenal juice was collected from six healthy subjects for 15 min basally and in seven 15-min periods of stimulation. The pH after reneutralization was between 6.8 and 7.6 in all samples. IF concentration was reduced by all of five samples of duodenal juice ($P < 0.05$). IF or unspecific viatmin $B_{12}$-binding concentrations were not significantly altered by pentagastrin (1 µg/kg/hr) stimulation. IF concentration was decreased by adding fourth to seventh period samples of secretin-stimulated (2 U/kg/hr) duodenal juice and incubating for 2 hr at 37 C. This small decrease was seen in all of six samples ($P < 0.05$) at all pH values. Unspecific $B_{12}$-binding concentration was increased in all samples with reduced IF concentration ($P < 0.05$). IF concentration was greatly reduced ($P < 0.05$) in all of six samples by first to third period samples of duodenal juice stimulated by 20% cholecystokinin (2 U/kg/hr), especially at low pH values. Unspecific $B_{12}$-binding showed similar values. Of 34 samples of gastric juice mixed with duodenal juice, 17 showed decreased intrinsic factor and unspecific $B_{12}$-binding concentrations. A simultaneous decrease of IF and increase of $B_{12}$-binding were seen in all samples with bilirubin concentrations above 1.5 mg/100 ml. These data indicate that IF measurements may be influenced by duodenal juice.

6943 EFFECT OF THYROIDECTOMY ON THE ACTIVITY OF α[SIC]-GLUCOSIDASES AND ACID HYDROLASES IN THE SMALL INTESTINE OF RATS DURING WEANING. *(Eng.)* Koldovsky, O.; Jumawan, J.; Palmieri, M. (Children's Hosp., Philadelphia, Pa. 19104). *J. Endocrinol.* 66(1):31-36, 1975.

The effect of thyroidectomy on the activity of the small intestinal β-glucosidases and acid hydrolases was studied in suckling Charles River rats. The pups were adrenalectomized on day 14 postpartum and half of them were thyroidectomized. At various times after surgery, the small intestine was divided into three segments and assayed for acid β-galactosidase, *N*-acetyl-β-glucosaminidase, β-glucuronidase, sucrase, maltase and protein. No sex differences were observed. Adrenalectomy slowed the growth of the animals and the small intestines; it also delayed the normal increase in the activities of sucrase and maltase and the normal decrease in the activities of acid β-galactosidase, β-glucuronidase, and *N*-acetyl-β-glucosaminidase during the third postnatal week. Simultaneous thyroidectomy had no effect on the adrenalectomy-induced inhibition of body weight and small intestinal growth, but it caused a further substantial delay in the maturation of the enzyme profile of the small intestine. The changes were observed in both the ileal and jejunal segments. The data indicate that the thyroid as well as the adrenals is involved in the regulation of enzyme activities during weaning, and that the thyroid can act independently of the adrenals on several intestinal enzymes.

6944 CYTOCHROME P-450 AND DRUG METABOLISM IN INTESTINAL VILLOUS AND CRYPT CELLS OF RATS: EFFECT OF DIETARY IRON. *(E.)* Hoensch, H.; Woo, C. H.; Schmid, R. (San Francisco Medical Center, Calif. 94143). *Biochem. Biophys. Res. Commun.* 65(1):399-406, 1975.

Drug-metabolizing activity in different cell populations of rat intestinal mucosa were investigated. Mature villous tip cells, functionally less differentiated intermediate villous cells and proliferating crypt cells were obtained from rats on various dietary regimens and assayed for benzpyrene hydroxylase and *p*-nitroanisole O-demethylase activity, and for cytochrome P-450 and $b_5$ content. Monooxygenase activity in microsomes from whole intestinal mucosa was highest in the upper small intestine and decreased progressively towards the terminal ileum. Mature villous tip cells contained more cytochrome P-450 and $b_5$ than those of more distal parts of the small intestine. The respective values for duodenal and ileal mucosa were: cytochrome P-450, 0.110 and 0.051 nM/mg of microsomal protein; and cytochrome $b_5$, 0.109 and 0.076 nM/mg. The activities of microsomal hemoproteins and drug metabolism in villous tip cells of duodenal mucosa were studied after maintenance on the following diets: standard chow diet; semisynthetic iron-supplemented diet; semisynthetic low iron diet for 2 days; and semisynthetic low iron diet for 2 days, followed by iron-supplemented diet for 24 hr. Cytochrome P-450 content and drug-metabolizing activity of villous tip cells after the third diet decreased to 42 and 13% of control values, but were restored within 24 hr in the last diet. These data suggest that intestinal drug metabolism is primarily localized in upper villous cells of duodenal mucosa, that cytochrome P-450 is synthesized in maturing epithelial cells as they migrate to the top of the mucosal villus, and that this process is critically dependent on dietary iron.

6945 EXPERIMENTAL PRODUCTION OF ELEVATED SERUM FOLATE IN DOGS WITH INTESTINAL BLIND LOOPS. II. NATURE OF BACTERIALLY PRODUCED FOLATE COENZYMES IN BLIND LOOP FLUID. *(E.)* Bernstein, L. H.; Gutstein, S.; Efron, G.; Wager, G. (Albert Einstein Coll. Medicine, Bronx, N.Y. 10461). *Am. J. Clin. Nutr.* 28(8):925-929, 1975.

The nature of the bacterially produced folate coenzymes present in intestinal blind loop fluid and the nature of the glutamate chain of these coenzymes were studied in canine jejunal and ileal blind loops. Twelve weeks after creation of each loop, the feculent material was removed and centrifuged. The supernatant fluid was removed, treated with mercaptoethanol, and eluted on standard DEAE Sephadex A-25 columns. The fluid was assayed with *Lactobacillus casei*, *Streptococcus faecalis*, and *Pediococcus cerevisiae*. Column chromatography of high and low blind

loop fluid revealed four discernible peaks when assayed by *L. casei:* augmentation of loop fluid with authentic folate coenzymes indicated that peak I was 5-formyltetrahydrofolic acid; peak II, 5-methyltetrahydrofolic acid; and peak III, tetrahydrofolic acid; peak IV was not identifiable. Assays with *S. faecalis* revealed disappearance of peaks II and IV, suggesting that peak IV was not free folic acid. Assays with *P. cerevisiae* revealed disappearance of peak II only. Peak IV was therefore a reduced folate utilizable by *P. cerevisae* and *L. casei* but not by *S. faecalis*. When fractions of peak IV were exposed to guinea pig intestinal lysosomal conjugate and reassayed with *S. faecalis*, folates of peak IV became available to this organism. Thus, peak IV was indeed a reduced triglutamate, presumably 5-formyltetrahydrofolate triglutamate. The occurrence of this compound in blind loop fluid indicates that polyglutamates can survive undigested within the lumen.

6946 INTESTINAL VILLUS AND CRYPT CELL RESPONSE TO CHOLERA TOXIN. *(E.)* Weiser, M. M.; Quill, H. (Harvard Medical Sch., Boston, Mass.). *Gastroenterology* 69(2):479-482, 1975.

The effect of cholera toxin on the adenylate cyclase activity of the small intestinal villus and crypt cells of fasted Holtzman rats (200 g each) was measured *in vivo* and *in vitro*. The rat abdomen was opened and two sections of midintestine (approximately 20 cm long and separated by 10 cm) were tied off and filled--the control loop with 0.154 M of NaCl and the test loop with cholera toxin (1 µg/ml in 0.154 M NaCl). Proximal and distal segments were used alternately for cholera toxin treatment. Villus tip to crypt cells were obtained in sequential order and pooled to give an upper, mid and lower villus fraction and a crypt fraction. Basal and fluoride-stimulated adenylate cyclase activities were measured after 3-hr incubation. Loops from proximal and distal segments showed similar responses to toxin treatment. Upper villus cell fractions exposed to cholera toxin showed a 3-fold increase in basal adenylate cyclase activity over controls. The lower villus cells also showed a significant increase in basal activity whereas crypt cell response was not significantly elevated. Fluoride-stimulated adenylate cyclase activity usually showed a slight decrease after exposure to cholera toxin. Low crypt cell adenylate cyclase activity was attributed to the lowered ability of cholera toxin to bind *in vivo* to crypt cells; the toxin did not appear to reach crypt cells in significant concentrations *in vivo* and incubation with $^{125}$I-cholera toxin demonstrated binding only to villus cells. No response could be demonstrated for isolated villus or crypt cells incubated with cholera toxin *in vitro*. Thus, cholera toxin was found to exert its major effect in intestinal villus cells rather than the crypt cells, suggesting that the crypt cell does not participate in the major changes observed with cholera toxicity.

6947 EFFECTS OF CRUDE AND PURE CHOLERA TOXIN ON PROSTAGLANDIN RELEASE FROM THE RABBIT ILEUM. *(E.)* Bedwant, J. R.; Okpako, D. T. (Dept. Pharmacology, Univ. Cambridge, England). *Prostaglandins* 10(1): 117-128, 1975.

The effects of crude and pure cholera toxins on the release of prostaglandin-like substances (PLS) from the rabbit ileum were investigated *in vivo* and *in vitro*. The ileum of the rabbits was perfused with buffer alone (Krebs-bicarbonate or Krebs-phosphate) followed by buffer containing crude toxin (lyophilized crude culture filtrate of *Vibrio cholerae*) (50 mg/ml) or pure toxin (10 µg/ml), followed by buffer alone. In three *in vivo* experiments, the inclusion of crude toxin in the perfusion fluid was followed by a release of PLS from the ileum. The amount of PLS rose from non-detectable (< 5 ng - < 19 ng $PGE_2$ Eq/30 min) during perfusion with buffer alone to peak values of approximately 37.5 ng $PGE_2$ Eq/30 min during or after perfusion with toxin containing buffer. In contrast, no detectable PLS was released when ileal loops were perfused with pure toxin. In two *in vitro* experiments with crude toxin at concentrations of 5 and 50 mg/ml in each, PLS in amounts up to 107 ng $PGE_2$ Eq/g tissue were found after one to four hr of incubation in the higher concentration of toxin. The pure toxin did not cause any detectable release of PLS from the ileum. In rabbits treated with 16 mg/kg indomethacin, fluid accumulation was diminished in sacs injected with either crude or pure toxin. Treatment with 1.6 mg/kg had no effect. It is concluded that crude and pure toxin have quantitatively similar effects on the secretion of fluid into ileal sacs *in vivo*. The results support the view that prostaglandins do not play an essential role in the action of cholera toxin on ileal fluid secretion. Because crude and pure cholera toxin differ in their effects on prostaglandin release, there is need for caution when interpreting results obtained with crude preparations of bacterial toxins.

6948 INHIBITION OF GUANYLATE CYCLASE AND CYCLIC GMP PHOSPHODIESTERASE BY CHOLERA TOXIN. *(Eng.)* Kiefer, H. C.; Atlas, R.; Moldan, D.; Kantor, H. S. (Northwestern Univ. Medical and Dental Sch., Chicago, Ill. 60011). *Biochem. Biophys. Res. Commun.* 66(3):1017-1023, 1975.

The effects of cholera toxin (injected *in vivo* into closed loops of distal ileum) on the activities of adenylate and guanylate cyclase and cyclic GMP phosphodiesterase were studied *in vitro* in rabbit small intestinal epithelial cells at periods 4 to 6 hr subsequent to toxin exposure. There was a simultaneous dose-dependent activation of adenylate cyclase and a deactivation of guanylate cyclase. In addition, the activity of phosphodiesterase catalyzing the hydrolysis of cyclic GMP was reduced in a dose-dependent fashion in most intestinal loops; approximately one of every 15 loops assayed failed to show a depression in cyclic GMP phosphodiesterase activity upon cholera toxin exposure, however. The values of the apparent dissociation constants representing the interaction of the toxin molecule (M.W., 84,000 daltons) with the receptors mediating all three observed cellular activities were similar: adenylate cyclase activation, $K_d = 5.0 \times 10^{-9}$ M; guanylate cyclase inhibition, $K_d = 4.4 \times 10^{-9}$ M; cyclic GMP phosphodiesterase repression, $K_d = 2.1 \times 10^{-9}$ M. The data indicate that cholera toxin interacts with a class of binding sites of average

affinity represented by $K_d = 3.8 \times 10^{-9}$ M; this binding appears to be of profound importance to the intracellular balance between cyclic nucleotides which may play a vital role in the cellular regulatory machinery.

6949 SMALL INTESTINAL GROWTH AND MUCOSAL DISACCARIDASE ACTIVITIES IN DIABETIC AND PROTEIN DEFICIENT PREGNANT RATS. *(E.)* Younoszai, M. K. (Dep. Pediatr., Univ. Iowa, Iowa City, Iowa). *Gastroenterology* 68(4):1016, 1975.

6950 PROSTAGLANDIN E (PGE) IN CHOLERA TOXIN (CT) INDUCED INTESTINAL SECRETION. *(E.)* Hindi, S.; Hudson, N.; Wilson, D. E. (Dep. Med., Univ. Illinois, Chicago, Ill.). *Gastroenterology* 68(4):1013, 1975.

6951 SERUM GASTRIN RESPONSE AFTER JEJUNECTOMY IN THE RAT. *(E.)* Flores, G.; Hughes, W.; Tawil, T.; Weser, E. (Univ. Texas Health Sci. Cent., San Antonio, Tex.). *Gastroenterology* 68(4):1012, 1975.

6952 THE ROLE OF PANCREATIC ENZYMES IN THE BREAKDOWN OF ANTIGENS AND ANTIGEN-ANTIBODY COMPLEXES ON THE SURFACE OF THE GUT. *(E.)* Walker, W. A.; Isselbacher, K. J.; Bloch, K. J. (Massachusetts Gen. Hosp., Boston, Mass.). *Gastroenterology* 68(4):1008, 1975.

6953 PEROXIDASE ACTIVITY AS A CHEMICAL INDEX OF INFLAMMATION IN THE SMALL INTESTINE. *(E.)* Smith, J. W.; Castro, G. A. (Univ. Texas Med. Sch., Houston, Tex.). *Gastroenterology* 68(4):989, 1975.

6954 THE MECHANISM OF DUODENAL DISPOSAL OF ACID AND ALKALI. *(E.)* Fiddian-Green, R. G.; Silen, W. (Harvard Med. Sch., Boston, Mass.). *Gastroenterology* 68(4):988, 1975.

6955 HEPATIC METABOLISM OF THE INTESTINAL PHASE HORMONE. *(E.)* Orloff, M. J.; Charters, A. C.; Knox, D. G. (Sch. Med., Univ. California, San Diego). *Gastroenterology* 68(4):964, 1975.

6956 SERUM GASTRIN AND SECRETIN LEVELS AFTER THE EXALTO-MANN-WILLIAMSON PROCEDURE. *(E.)* Tasse, D. P.; Kolts, B. E.; Barefoot, S. W.; McGuigan, J. E.; Woodward, E. R.; Dragstedt, L. R. (Univ. Florida Coll. Med., Gainesville, Fla.). *Gastroenterology* 68(4):950, 1975.

6957 EFFECT OF AGING ON MUCOSAL ACYL-COA: MONOGLYCERIDE ACYLTRANSFERASE ACTIVITY. *(E.)* Masuda, M.; Hosoda, S.; Bamba, T.; Nakajo, S.; Nisino, H. (Kyoto Prefectural Univ. Med., Kyoto, Japan). *Gastroenterology* 68(4):947, 1975.

6958 OBSERVATIONS ON PLASMA RIA SECRETIN RESPONSES IN DOGS. *(E.)* Lee, K. Y.; Chey, W. Y.; Tai, H. H.; Hendricks, J. (Genesee Hosp., Rochester, N.Y.). *Gastroenterology* 68(4):934, 1975.

6959 INTESTINAL PHASE OF GASTRIC SECRETION. *(E.)* Knoturek, S. J.; Kaess, H.; Radecki, T.; Kwiecien, N. (Inst. Physiol., Cracow, Poland). *Gastroenterology* 68(4):928, 1975.

6960 METABOLIC MODIFICATIONS OF JEJUNUM ISOLATED FROM RATS KEPT IN CONTINUOUS LIGHT OR DARKNESS. *(Fr.)* Sadeghi Louyeh, A. (Faculte de Medicine, Universite de Teheran, Teheran, Iran). *J. Physiol. (Paris)* 70(1):111-114, 1975.

6961 FOLLOWING SMALL INTESTINE TRANSPLANTS BY CONSECUTIVE ASPIRATION BIOPSIES OF THE MUCOSA. *(Ger.)* Stauffer, U. G.; Mona, D.; Shmerling, D. H. (Univ.-Kinderklinik Zurich, Steinwiesstrasse 75, CH-8032, Zurich, Switzerland). *Z. Kinderchir. Grenzgeb.* 16(1):32-37, 1975.

6962 ADAPTATION OF DISACCHARIDE DIGESTION FOLLOWING EXTENSIVE RESECTION OF THE SMALL INTESTINE IN THE RAT. *(Pol.)* Bochenek, W. (Academy Medicine, Wroclaw, Poland). *Przegl. Lek.* 31(2): 340-344, 1974.

6963 INTESTINAL AMMONIUM PRODUCTION IN THE NORMAL RAT. COMPARISON OF THE EFFECTS OF ANTIBIOTICS AND LACTULOSE. *(Fr.)* Imler, M.; Peter, B.; Schlienger, J. L.; Lavillaureix, J.; Stahl, J.; Reeb, E.; Frick, A. (Centre Hospitalier Universitaire, F 67005 Strasbourg Cedex, France). *Med. Chir. Dig.* 4(1):15-20, 1975.

6964 CULTURES OF MUCOSA FROM THE SMALL INTESTINE. *(Fr.)* Rampal, P,; Delmont, J. (Centre Hepato-Gastroenterologie, 4, avenue Reine-Victoria, F 06100 Nice, France). *Arch. Fr. Mal. App. Dig.* 64(2):159-169, 1975.

6965 INTESTINAL RADIATION INJURY: THE LOWER BOWEL SYNDROME. *(E.)* Sullivan, M. F.; Ruemmler, P. S.; Beamer, J. L.; Mahony, T. D. (Biology Dept. Battelle Pacific Northwest Lab., Richland, Washington 99352). *Radiat. Res.* 62(3):579, 1975.

6966 CARBOHYDRATE DIGESTION AND ABSORPTION. ROLE OF THE SMALL INTESTINE. *(E.)* Gray, G. M. (Stanford Univ. Medical Sch., Stanford, Calif.). *N. Engl. J. Med.* 292(23):1225-1230, 1975.

6967 COMBINED IMMUNOSUPPRESSION IN SMALL-BOWEL ALLOTRANSPLANTATION IN THE DOG. *(E.)* Alberu, J.; Wolpert, E.; Chavez-Peon, F. (Dept. Cirurgia Experimental Instituto Nacional de la Nutricion, Mexico City, Mexico). *Transplant. Proc.* 7(1):775-778, 1975.

6968 EFFECTS OF ANTHRAQUINONE HETEROSIDES ON THE DIGESTIVE TRACT OF THE RAT: HISTOENZYMATIC STUDY. *(Fr.)* Wegmann, R. (Inst. Med. Histochem. Paris, France). *Ann. Histochim.* 19(2): 131-150, 1974.

See also, 6594, 6597, 6598, 6604, 6606, 6608, 6611, 6626, 6636, 6642, 6758, 6856, 6864, 7843, 7903.

## GENERAL

6969 MICROCIRCULATION OF THE CAT STOMACH. *(E.)* Svanes, K.; Skarstein, A.; Svanes, T. (Dept. General Surgery, Univ. Bergen, Norway). *Eur. Surg. Res.* 7(1):53-64, 1975.

Carbonized microspheres (15 μm in diameter) were used for estimation of the microcirculation in different layers and regions of the cat stomach. $^{169}Yb$, $^{85}Sr$ and $^{141}Ce$-labeled microspheres (2-3 million) suspended in 0.3 to 0.5 ml of 10% dextran were injected into the left cardiac ventricle of anesthetized male and female cats. Cats were divided into groups of controls (receiving microspheres labeled with $^{85}Sr$); a group with gastrin labeling with $^{169}Yb$, followed by i.v. infusion of pentagastrin (0.15-0.30 μg/kg/min), then injection of $^{85}Sr$-labeled microspheres; a norepinephrine group, labeled with $^{141}Ce$, followed by an i.v. infusion of the drug (2 μg/kg/min), and then by injection of $^{85}Sr$-labeled microspheres. The last two groups were laparotomized and a gastric ulcer was induced by 20% acetic acid (0.3 ml, s.c.), resp. The majority of labeled microspheres in the mucosa samples were found in the propria and in the glandular layer, with only a few in the submucosa. Muscularis samples showed the majority of the labeled spheres in muscle tissue, with only 1 to 9% present in the submucosa. In cats with ulcers, blood flow was markedly increased in both mucosa and muscularis samples in the ulcer region, due to high flow in the inflammatory granulation tissue. It is concluded that this method gives an accurate picture of capillary blood flow in the glandular layer of the mucosa and in the muscularis.

6970 PEYER'S PATCHES, GUT IgA PLASMA CELLS AND THYMIC FUNCTION: STUDY IN NUDE MICE BEARING THYMIC GRAFTS. *(E.)* Guy-Grand, D.; Griscelli, C.; Vassalli, P. (Hopital Necker-Enfants Malades, Paris 75015, France). *J. Immunol.* 115(2):361-364, 1975.

Experiments on nude mice were designed to correlate the effects of thymus grafting on development of Peyer's patches, frequency of intestinal mucosa immunoglobulin A (IgA) plasma cells, and serum IgA levels. Three to five thymus fragments obtained from 16- to 20-day-old BALB/c fetuses were placed in the peritoneal cavity of 8- to 10-week-old nude mice with BALB/c background. Controls were normal BALB/c mice. Immunofluorescent staining and $^{3}H$-thymidine labeling of cell suspensions or tissue sections were used to detect intestinal IgA plasma levels and T lymphocytes. Serum IgA levels were determined by Laurell crossed electrophoresis. Thymus grafts to nude mice caused a steady increase in the percentages of mouse T lymphocyte antigen$^{+}$ lymphocytes: 8-35% in the spleen, 16-57% in the peripheral lymph nodes, 15-48% in the mesenteric lymph nodes, and 8-15% in the Peyer's patches at 30 and 100 days, resp. The Peyer's patches of grafted nude mice when compared to ungrafted nude mice increased in size and could not be distinguished from those of normal BALB/c mice. They possessed well-developed germinal centers, large numbers of rapidly dividing cells, increased T lymphocyte populations in the interfollicular and germinal centers, increased numbers of intestinal IgA plasma cells and intraepithelial T cells of the intestinal mucosa, and higher serum IgA levels. Thus, thymus grafting has a pronounced effect on the development of Peyer's patches germinal centers and on the contents of the intestinal mucosa in IgA plasma cells. These findings may explain the association of thymic defects, low serum IgA, and lack of intestinal IgA plasma cells observed in some immunodeficiency syndromes of man.

6971 THE EFFECT OF SYMPATHETIC NERVE STIMULATION ON ACID SECRETION, REGIONAL BLOOD FLOWS AND OXYGEN USAGE BY STOMACHS OF ANAESTHETIZED CATS. *(E.)* Grund, E. R.; Reed, J. D.; Sanders, D. J. (Medical Sch., Univ. Newcastle upon Tyne, England). *J. Physiol.* 248(3):639-647, 1975.

To determine whether splanchnic nerve stimulation has a direct inhibitory effect on parietal cell activity, oxygen consumption and extraction by the stomach were measured in cats during gastrin pentapeptide stimulation with and without concomitant splanchnic nerve stimulation. The fasted, anesthetized animals were subjected to pylorus ligation, after which a catheter was passed into the pyloric antrum. Both vagus nerves were sectioned and the splanchnic nerves were cut extraperitoneally on both sides; ring electrodes were placed on the distal ends of the splanchnic nerves. Gastric activity was stimulated by i.v. gastrin pentapeptide (20 μg/10 min) and the splanchnic nerves were continuously stimulated (10 Hz) for two consecutive 10-min periods. Gastric acid output was measured by electrometric titration to pH 7 and the oxygen concentrations in the arterial and gastric venous blood were measured using an oximeter. Splanchnic nerve stimulation significantly reduced the acid output and total gastric and mucosal blood flows produced in response to maximal gastrin pentapeptide infusion. The arterial hemoglobin concentration was also significantly reduced during splanchnic nerve stimulation, and the total gastric oxygen consumption was significantly reduced during the periods when the mucosal blood flow and acid secretion were inhibited. The data indicate that oxygen consumption and acid secretion decline in parallel during splanchnic nerve stimulation, but that the percent oxygen ex-

traction by the stomach does not change significantly. These findings support the hypothesis that splanchnic nerve stimulation directly inhibits parietal cell activity.

6972 SUBCELLULAR LOCATION AND THE EFFECTS OF VARIOUS HORMONE STIMULI ON ADENYLATE CYCLASE IN THE INTESTINAL MUCOSA OF THE GUINEA PIG. *(Fr.)* Bouhours, D.; Bouhours, J. F.; Lambert, R. (Edouard Herriot Hosp., Lyon, France). *Biol. Gastroenterol. (Paris)* 7(4):275-283, 1974.

Female albino guinea pigs underwent food deprivation (18 hr) prior to cervical dislocation. Intestinal mucosa homogenate adenylate cyclase activity was assayed with and without NaF, in nonpurified brush border preparation (BB+N), in purified brush border preparation (BBp), and in 2,000 *g* pellet from brush border preparation supernatants, the resulting sediment having been called MP. Through testing, MP seemed to be made of impure lateral and basal membranes, BBp, of microvillus membranes noncontaminated by mitochondria and microsomes. The effect of adenylate cyclase was sought in the three preceding preparations; the MP fraction demonstrated the most activity followed by BB+N and then by BBp. But when NaF was added, even the BBp could become active. The activation mechanism of adenylate cyclase was presumed to be one of steric modification. This would explain the behavior of BBp; the enzyme would stay under the control of its regulatory protein until stimulation by NaF. The high activity of MP was tested for the presence of a hormonal factor or for a partial dislocation of the membranous structure. Three factors have been known to stimulate adenylate cyclase: (1) NaF, (2) cholera toxin, and (3) prostaglandins. Other hormones tested *in vitro* proved ineffective in stimulating intestinal adenylate cyclase. It appears impossible to link any intestinal hormone on a cause and effect basis to the secretion of adenylate cyclase.

6973 COLONIZATION OF THE GUT OF "GNOTOXENIC" RATS AND MICE BY TEN STRAINS OF STRICTLY ANAEROBIC BACTERIA: INFLUENCE OF THE HOST AND ITS DIET. *(Fr.)* Ducluzeau, R.; Raibaud, P.; Ladire, M.; Riottot, M.; Chopin, A. (Natl. Center Zootechnological Res., Jouy-en-Josas, France). *Ann. Inst. Pasteur (Paris)* 124B(4): 517-532, 1973.

Ten strictly anaerobic bacterium species (*Pasteurella vulgata, Veillonella alcalescens, Clostridium difficile, Acuformis perennis, Streptococcus intermedius, S. putridus, Eubacterium parvum, Ristella putredinis, Inflabilis mangenoti,* and *Zymobacterium* sp.), isolated from the guts of conventional rats, were seeded in cecumectomized and noncecumectomized germ-free Fischer rats and C3H mice. The animals were kept on conventional diet, on commercial diet with additional lactose, on cow's milk, or on a semi-synthetic diet composed of 580 g of corn starch, 220 g of casein, 90 g of corn oil, 1 g of chromium oxide, 50 g of cellulose, vitamins, and inorganic salts. *Pasteurella, Acuformis,* and *Veillonella* were dominant in noncecumectomized rats and mice, regardless of diet, while *Eubacterium* and *Clostridium* were usually present in the subdominant flora. *Ristella, S. putridus* and *Zymobacterium* were also present in the subdominant flora of the rats, but they were absent in mice fed an identical diet. *Inflabilis* did not persist in any subjects. The addition of lactose did not modify this equilibrium in mice, but semi-synthetic diet caused a fall in the population of most species. In mice fed only cow's milk, the final equilibrium was between that observed with commercial diet and with semi-synthetic diet. Cecumectomy resulted in a drop in the bacterial population of the stomach and of the small intestine, and in the number of *S. putridus* throughout the digestive tract.

6974 A CONTRIBUTION TO THE PHYSIOLOGY OF THE ISOLATED DOG PANCREAS—THE INFLUENCE OF THE ACTUAL BLOOD GLUCOSE LEVEL ON BLOOD CIRCULATION IN THE PANCREAS. *(Ger.)* Hempfling, H.; Husemann, B. (Chirurgische Universitats-Klinik, Nurnberg, Germany). *Arzneim. Forsch.* 25(6):916-918, 1975.

6975 PLASMA CONCENTRATION OF ZINC AND COPPER AFTER INTESTINAL SHORT CIRCUIT. *(Fr.)* Montorsi, W.; Annoni, F.; Doldi, S. B.; Germiniani, R.; Longoni, F. (Greater Polyclinical Hosp., Univ. Milan, Milan, Italy). *Nouv. Presse Med.* 4(23):1734, 1975.

6976 THE EFFECT OF THE EPITHELIAL CELLS OF THE INTESTINAL MUCOSA, THEIR SUBCELLULAR CULTURES AND COMPLEMENT ON THE VIABILITY OF CHOLERA BACILLUS. *(Rus.)* Adamov, A. K.; Klassovskaia, T. L. (Natl. Mikrob. Anti-plague Inst., Saratov, USSR). *Zh. Mikrobiol. Epidemiol. Immunobiol.* 52(1):138-139, 1975.

6977 STUDIES OF LOCAL AND CERTAIN GENERAL IMMUNOLOGICAL REACTIONS USING THE MODEL OF EXPERIMENTAL DYSENTERIC ENTEROCOLITIS IN GUINEA PIGS. *(Rus.)* Miroliubova, L. V.; Blinova, N. I.; Petrovskaia, V. G. (Gamaleia Inst. Epidemiol. Microbiol., Moscow, USSR). *Zh. Mikrobiol. Epidemiol. Immunobiol.* 52(1):123-124, 1975.

6978 SUSCEPTIBILITY OF GUINEA PIGS UNDER STRESS TO PERORAL INFECTION BY Shigella sonnei. *(Rus.)* Balashov, M. P. (Leningrad Inst. Vaccines Sera, Leningrad, USSR). *Zh. Mikrobiol. Epidemiol. Immunobiol.* (1):137-138, 1975.

6979 PROBLEMS IN THE HORMONAL REGULATION OF GASTROINTESTINAL FUNCTION. *(Rus.)* Klimov, P. K. (I. P. Pavlov Inst. Physiology, Leningrad, USSR). *Ter. Arkh.* 47(2):129-136, 1975.

6980 RADIOMETRIC AMINOPYRINE CLEARANCE TECHNIC FOR DETERMINING GASTRIC MUCOSAL BLOOD FLOW. *(E.)* Tague, L. L.; Jacobson, E. D. (Univ. Texas Med. Sch., Houston, Tex.). *Gastroenterology* 68(4): 995, 1975.

6981 PROGNOSIS OF THE OUTCOME AND DIAGNOSIS OF PARATYPHOID B IN MICE BY THE ENZYMATIC STATUS OF LYMPHOCYTES AND NEUTROPHILS. *(Rus.)* Katosova, L. K.; Katosova, R. K.; Levina, L. A.; Nartissov, P. (Mechnikov Inst. Vaccines Sera, Moscow, USSR). *Zh. Mikrobiol. Epidemiol. Immunobiol.* (1):75-80, 1975.

6982 THE ROLE OF BLOOD OUTFLOW DISORDERS IN GASTRIC DISEASE. *(Rus.)* Norkunas, P. I.; Lapinskas, V. I. (Dept. Hosp. Surgery, V. Kapsukas Univ., Vilnius, USSR). *Ekspr. Khir. Anesteziol.* (1):33-36, 1975.

6983 PEYER'S PATCHES AND CELLULAR IMMUNITY. *(Fr.)* Eloy, R.; Vuitton, D.; Garaud, J. C.; Vaultier, J. P.; Klein, M.; Grenier, J. F. (INSERM U-61, avenue Moliere, F 67200 Strasbourg-Hautepierre, France). *Biol. Gastroenterol. (Paris)* 8(1):73-86, 1975.

6984 IN VITRO COMPARATIVE EVALUATION OF TINIDAZOLE AND METRONIDAZOLE ON STRAINS OF Entamoeba histolytica. *(E.)* MaHajan, R. C.; Chitkara, N. L.; Vinayak, V. K.; Dutta, D. V. (Postgrad. Inst. Med. Educ. Res., Chandigarh, India). *Indian J. Pathol. Bacteriol.* 1,(4):226-228, 1974.

See also, 6780.

# DIAGNOSTIC PROCEDURES

6985 AZYGOGRAPHY IN ESOPHAGEAL CANCER. *(Sp.)* Sans Segarra, M.; Curto Cardus, J.; Jori Sole, X.; Olazabal, A. (Principes de Espana Munic. Hosp., Barcelona, Spain). *Rev. Esp. Enferm. Apar. Dig.* 42(6):685-698, 1974.

Azygography is recommended for the selection of patients with operable esophageal tumors for surgery. After patients are fasted for 6-8 hr, a sedative is administered 1 hr before examination. With the patient in a prone position, a chest x-ray is taken. Then a local anesthetic (3-5 ml mepivacaine containing 1% epinephrine) is injected as far as the periosteum at the level of the 10th rib and posterior axillary line on the right side for the azygos major and on the left for the azygos minor. When the area is sufficiently anesthetized, a trochar is inserted so that contrast medium can be injected into the intercostal vein after more local anesthetic has been administered. It is recommended that the procedure be monitored on a television screen. Iodamide (15-20 ml) is injected as rapidly as possible, x-rays are taken during injection of the last ml of contrast medium, and changes in the azygogram are studied as the patient performs the Valsalva manuever. This demonstrates any delay in flow in the azygous system. Since some patients have normal findings on one side and a block at a distance from the tumor on the other, indicating the presence of lymph node metastases, bilateral examinations should by performed routinely. Marked reflux is considered indicative of hypertension in the azygous system which results from a block at some level in its path. In about 10% of the patients examined, thoracoaxillary collaterals were observed without any sign of hypertension. Few complications occurred. One patient developed pneumothorax and another was hypersensitive to the contrast medium; both complications resolved rapidly and spontaneously. In some patients, contrast medium diffused through soft tissues and the patients developed inflammatory tumefactions and pain which lasted 5-7 days. Local heat and antiinflammatory ointment produced reabsorption.

6986 THE BUDD-CHIARI SYNDROMES: RADIOLOGIC DIAGNOSIS. *(Fr.)* Bigot, J. M.; Chermet, J.; Monnier, J. P. (Hopital St. Antoine, Paris, France). *Ann. Radiol. (Paris)* 17(5):451-469, 1974.

The Budd-Chiari syndrome was defined as a secondary obstruction of the hepatic veins, the diagnosis of which was made by radiographic and phlebographic studies. Fifty patients (mean age 30 yr) were observed over the past 18 yr. The clinical aspects which brought the patients to the hospital were the following: possible decompensated hepatic cirrhosis with edema of the lower extremities or hepatomegaly. Absence of any etiology to this pseudo-cirrhotic syndrome as well as the observation of a collateral basithoracic, presternal and epigastric circulation were of high value. The existence of polycythemia and the use of laporophotography proved essential in the diagnosis. The methods used in this study were precise and sequential: inferior cavography, catheterization of the right heart, tentative selective retrograde catheterization of the hepatic veins and transhepatic transcutaneous venography (VTH), the latter being a precise technique with few risks. This was followed by selective arteriography of the celiac trunk and the superior mesenteric artery. The VTH seemed to be the only radiologic exam which would actually prove the syndrome. Three types of pictures were obtained through VTH: no opacification of the right hepatic vein, total ostial obstruction and dilatation with stasis in the hepatic veins. The overall arteriograph show increased density of the caudal lobe, hypervascularization of the right diaphragmatic dome, and hepatic hypervascularization. The results are confirmed by surgery.

6987 BARIUM OR GASTROGRAFIN: WHICH CONTRAST MEDIA FOR DIAGNOSIS OF ESOPHAGEAL TEARS? *(E.)* James, Jr., A. E.; Montali, R. J.; Chaffee, V.; Strecker, E. P.; Vessal, K. (Johns Hopkins Med. Inst., Baltimore, Md.). *Gastroenterology* 68(5): 1103-1113, 1975.

The effects of barium sulfate, alone and in combination with normal esophageal flora, on the mediastinum were compared with those of meglumine diatrizoate, a water-soluble contrast-medium. Twenty-nine domestic adult cats were divided into groups: operative controls, barium, meglumine diatrizoate, flora, meglumine diatrizoate plus flora, and barium plus flora. A total volume of 1 ml of substance was instilled into the mediastinum of each cat. The animals were sacrificed at serial time intervals following mediastinal injection. The water-soluble contrast media caused no significant histological reaction. Barium caused granuloma formation but had no additional deleterious effects when mixed with flora. Barium, due to its superior physical properties of mucosal coating and radiographic density, should be employed as the contrast agent of choice in difficult clinical problems with regard to esophageal tears. As a practical compromise, it is suggested that in patients with suspected tear of the esophagus, a limited upper gastrointestinal series with a water-soluble contrast agent be obtained. If this initial study is negative, it should then be repeated using barium as the contrast medium.

6988 EVALUATION OF CARBON-11 LABELLED PHENYLGLYCINE AND PHENYLALANINE FOR PANCREAS SCINTIGRAPHY. *(E.)* Vaalburg, W.; Beerling-van der Molen, H. D.; Woldring, M. G. (Academic Hosp., Univ. Groningen, The Netherlands). *Nucl. Med.* 14(1):60-66, 1975.

The tissue distribution of DL-α-phenylalanine-1-$^{11}$C and DL-α-phenyl-glycine-1-$^{11}$C in rats was studied, and the uptake of these compounds by the pancreas and liver was compared with the accumulation of L-selenomethionine-$^{75}$Se and $^{18}$F-labeled amino acids. About 1 mg of the labeled amino acids were injected into the femoral veins of male Wistar rats under light anesthesia and the rats were killed at various intervals thereafter. The radioactivity in a blood sample taken before killing and in the liver, spleen, kidneys, and pancreas was determined. Based on the results, the ratios of the concentrations in the pancreas and liver were calculated and compared with the corresponding ratios reported in the literature

for some $^{18}F$-labeled aromatic amino acids and L-selenomethionine-$^{75}Se$. The results indicated that DL-α-phenylglycine-1-$^{11}C$, in spite of a small percentage of the administered dose reaching the pancreas, and DL-α-phenylalanine-1-$^{11}C$ are better suited for pancreas scintigraphy than is L-selenomethionine-$^{75}Sc$.

6989 THE STATUS OF AND INDICATIONS FOR CELIOMESENTERIC ARTERIOGRAPHY IN GASTROINTESTINAL BLEEDING OF PANCREATIC ORIGIN. *(Fr.)* Vankemmel, M. (Municipal Hosp., Lille, France). *Ann. Chir.* 27(6): 642-651, 1973.

The value and indications of celiomesenteric angiography in the diagnosis of gastrointestinal hemorrhages of pancreatic origin are presented on the basis of a patient material. Aneurysms of the splenic artery, intrahepatic arteries, localized dorsal pancreatic aneurysms, splenic and gastroduodenal arterial and arteriolar aneurysms, and pancreatico duodenal cirsoid aneurysms were diagnosed by celiomesenteric angiography in gastrointestinal bleedings of pancreatic origin. Preoperative arteriography permits logical surgical procedure adapted to the individual case, thus avoiding unnecessary gastric mutilation. In pancreatopathies, celiomesenteric arteriography furnishes information on the splenomesenterico-portal venous axis and on arterial lesions that may exist concurrently with venous involvement. Angiography provides a morphological picture indispensable for exploration for chronic pancreatitis, pseudocysts, or late evolutive complications of acute pancreatitis. Small opaque pseudo-aneurysms are pathognomonic of arterial erosion.

6990 MESENTERIC ANGIOGRAPHY IN INFLAMMATORY DISORDERS OF THE SMALL INTESTINE AND MESENTERIC INFARCTION. *(Ger.)* Dombrowski, H.; Pemsel, H. K. (Univ. Med. Clin., Marburg, Germany). *Radiologe* 14(9):415-424, 1974.

The value of mesenteric angiography for diagnosis and differential diagnosis in inflammatory disorders of the small intestine, such as Crohn's disease, malabsorption syndrome, collagen diseases, and mesenteric infarction is discussed. Angiography in Crohn's disease is suitable for preoperative determination of activity in the small and/or large intestines, for the preoperative detection of adhesions and loop conglomerates, for differentiation between vascular process and lymphosarcoma in atypical forms of Crohn's disease, between Crohn's disease and ischemic colitis, and for the differential diagnosis of colitic stricture. Arterial hypervascularization, intense wall contrast, premature venous reflux, conspicuous distance between the inner contrasted wall layers and the subserous arteries, and transposition of higher intestinal arteries are the diagnostic features of different stages of Crohn's disease. Angiography can be used as an auxiliary diagnostic tool in certain special clinical cases of malabsorption syndromes. Angiography is valuable in the diagnosis of collagenoses, especially of periarteritis nodosa, which features irregularities in the vessel diameters, thrombotic occlusions, and miliary aneurysms of the medium and small arteries of the kidneys and of the gastrointestinal tract. In acute embolism of the superior mesenteric artery, angiography helps differentiate between acute proximal obturation and embolism in the peripheral branches. It is possible to localize the obturation, and to demonstrate a possible collateral perfusion. Reduced flow in the superior mesenteric artery, possible reflux into the aorta, and delayed or reduced filling of the peripheral section of the artery are found in thrombosis in the mesenteric vein.

6991 NEW TEST FOR PANCREATIC EXOCRINE FUNCTION: JEJUNAL PERFUSION OF AMINO ACIDS. *(Fr.)* Ertan, A. (Departement de Gastroenterologie, Faculte de Medecine, Universite d'Ankara, Turquie). *Arch. Fr. Mal. App. Dig.* 64(2):107-114, 1975.

A jejunal perfusion of amino acids (JPAA) determined a release of cholecystokinin-pancreozymin (CCK), the effects of which were comparable to administration of a full dose of this hormone. Eight chronic pancreatitis patients, all alcoholics having an exocrine pancreatic secretion deficiency, and eight healthy controls were selected. Two probes (I and II, resp.) were placed at 40 cm below the duodenal junction (distal to the ligament of Treitz) and at the level of the fourth part of the duodenum. Probe I was subdivided into two smaller probes (A and B): probe A was used as a radio-opaque indicator; probe B was used to perfuse a mixture of amino acids. Probe II was subdivided into four smaller probes (C, D, E and F): C aspirated duodenal fluid, probe D insufflated air to facilitate probe C's work, probe E was used to perfuse a phenol solution (a nonabsorbed marker), and probe F aspirated gastric juices so that pancreatic juices would not be stimulated by acidification of the duodenum. Duodenal liquid was collected every 15 min on all 16 subjects and the pH, volume, bicarbonate concentration, trypsin, amylase, lipase, total protein, biliary acid and bilirubin levels were measured. The levels of the two latter were identical in both groups, suggesting that endogenous liberation of CCK stayed normal in chronic pancreatitis patients; all the other measured elements had lower levels for the CP group. This method may be of value in situations in which stimulation of the pancreas is desired.

6992 LIVER BIOPSY WITH GUIDANCE IN SCANNING. A PRELIMINARY REPORT. *(E.)* Erasmie, U. (Karolinska Sjukhuset, S-104 01 Stockholm, Sweden). *Acta Radiol. [Diagn.] (Stockh.)* 16(1):49-53, 1975.

A method of introducing the biopsy instrument into the liver under fluoroscopic control for the use in liver scanning is presented. The method calls for scanning of the liver by a scintillation camera with a persistence oscilloscope. Following the i.v. administration of 2 mCi of $^{99m}Tc$ sulfur colloid, recordings are made in a.p., p.a. and lateral projections. Rings of metal of high radiation absorption serve as indicators. The ring is carefully adjusted to a position right above the lesion on the liver. Leaving the patient in an unchanged position, the head of the gamma camera is revolved and the location of the lesion is determined. In direct comparison with the known ring

diameter, estimations of dimensions can be made on liver scan in levels paralled to the ring. Thus, the diameter of a lesion with a reduced isotope uptake may be determined and the size of the liver be approximated. Liver biopsy is performed with the patient in the same position as during the indication of the lesion. The biopsy instrument is inserted from a suitable position, usually the right side, horizontally at level with the center of the side ring. Under fluoroscopic control the instrument is introduced into the liver. The point of the needle should then be positioned centrally in the region of reduced isotope accumulation to permit sampling of tissue material. This technique was applied in 19 patients with the following results: the diameter of the lesion was between 3 and 6 cm in eight cases, 6 and 9 cm in eight cases, and more than 9 cm in three cases; cytology revealed carcinoma cells in ten patients; in five cases normal liver tissue was obtained. The results for the remaining four patients consisted of: a distended gallbladder with a stone in its neck; a case of biliary obstruction; a local, radiation-induced hepatitis; and a case in which diagnosis was uncertain. No complications in connection with the biopsies were encountered. It is concluded that liver scanning is a useful screening method of high accuracy.

5993 INDICATIONS FOR AND VALUE OF ENDOSCOPIC RETROGRADE CHOLANGIOPANCREATOGRAPHY. *(Ger.)* Halter, F. (Inselspital, CH-3010 Bern, Switzerland). *Schweiz. Med. Wochenschr.* 105(15):476-480, 1975.

In a 2.5 yr period, retrograde cholangiopancreatographic (ERCP) examinations were performed on 159 patients. Premedication consisted of diazepam (5-20 mg i.v.) or mependine hydrochloride (1 mg/kg), either alone or combined with 5-10 mg diazepam. The papilla of Vater was seen in seven of the first 10 examinations, but duct systems were catheterized in only two cases (20%). With increasing experience it was possible to catheterize 85% of the last 130 patients. In 17 of the 32 cases in which catheterization could not be performed, it was impossible to see the papilla; the catheter slipped away in seven, three patients were uncooperative, and extravasation of the contrast medium occurred in two. In one case each, there was a Billroth II gastroenterostomy, a papillary carcinoma, and a nonfasting patient. The mean time required to perform RCP examinations was 54.4 min. In the 127 cases in which it was possible to introduce the catheter, both duct systems were visualized in 58 cases (43.3%), only the pancreatic duct in 44 (34.0%), and only the bile duct in 25 (19.6%). Diagnoses were established in 41 (73.1%) of 56 patients with clinical signs of biliary disease, in 15 (65.2%) of 23 patients suspected of having biliary and pancreatic disease, and in 48 (60.9%) of 80 patients suspected of pancreatic disease. In the 104 cases in which a diagnosis was established, findings were normal in 50 (31.4%) and pathological in 54 (34%). With the use of ERCP, the following findings were made: chronic pancreatitis in 20 cases, choledocholithiasis (16), pancreatic carcinoma (6), biliary carcinoma (2), papillary carcinoma (2), postoperative stenosis of the bile duct (1), papillary stenosis (2), cholecystolithiasis (2), insufficiency of the duodenal stump following a Billroth II procedure and cholecystectomy (1), and postcholecystectomy syndrome resulting from cutting of the right hepatic duct (1).

6994 COMPLICATIONS OF ENDOSCOPIC RETROGRADE CHOLANGIOPANCREATOGRAPHY: ANALYSIS OF 300 CONSECUTIVE CASES. *(E.)* Zimmon, D. S.; Falkenstein, D. B.; Riccobono, C.; Aaron, B. (Manhattan Veterans Administration Hosp., New York, N.Y.). *Gastroenterology* 69(2):303-309, 1975.

Complications of endoscopic retrograde cholangiography were reviewed in 300 consecutive attempts at the procedure in 278 patients. In 79%, either the pancreatic and/or bile ducts were opacified. Retrograde pancreatograms were obtained in 192 cases and retrograde cholangiograms in 141 cases. In all there were 15 complications, a 5% incidence. In 62 cases, neither duct was opacified. Seven complications were drug-related, including behavioral disturbances in five, choking with emesis in one, and respiratory depression in one. Brief, self-limited pancreatitis after retrograde pancreatography occurred in five of 90 patients with pancreatic disease. Three patients developed septicemia within 72 hr after the procedure. In 85 cases, the procedure was performed in the absence of extrahepatic biliary disease; there were no complications. In 56 cases where the procedure showed extrahepatic pathology, three cases of sepsis occurred, a statistically significant increase in incidence. It is concluded that the procedure has no absolute contraindications, and compares favorably with other equally useful procedures.

6995 ACCURACY OF ULTRASOUND IN DIAGNOSING ABDOMINAL MASSES. *(Eng.)* Richardson, R.; Norton, L. W.; Eule, J.; Eiseman, B. (Denver General Hosp., Denver, Colo. 80204). *Arch. Surg.* 110(8):933-939, 1975.

Over a 7-yr period, B-mode ultrasonography was performed in 246 patients with suspected abdominal masses. The accuracy of the ultrasonic diagnosis was evaluated in 105 (43%) of the cases, and proven correct in 60 (57%) of these 105. Of the remaining 141 patients, those who did not undergo surgery and whose diagnoses had been established by other means, the ultrasonic diagnosis agreed with the clinical diagnosis in 69 cases (31%). As confirmed by surgery, the accuracy of the ultrasonic diagnosis was highest for splenic masses (100%) and for aortic aneurysm (88%). In 56% of the patients, liver masses were correctly identified; gallbladder lesions were identified correctly in 38%. In diagnosing pancreatic disease, a 48% accuracy was obtained, but 64% of all pseudocysts were localized. In 56% of the renal masses, ultrasonography correlated positively. In 61% of the patients, abscess was accurately diagnosed. However, retroperitoneal adenopathy was correctly diagnosed in only 33%. It is concluded that abdominal ultrasonography, while accurate in diagnosing splenic and aortic masses, did not identify more than half of the other mass lesions. It is suggested that

improvements in technique should upgrade the accuracy of this diagnostic tool.

6996 THE POSITION OF ECHOTOMOGRAPHY IN GASTROENTEROLOGY AND HEPATOLOGY: PRELIMINARY STUDY OF 135 CASES. *(Fr.)* Dofing, J. L. (No affiliation given). *Rev. Fr. Gastroenterol.* (103): 65-66, 68, 70-71, 1974.

Echotomography may be used in parellel with the clinical exam or to complement radiologic, scintigraphic or ultrasonic investigations. A total of 135 patients were studied and classified into three groups: those suffering from (1) palpable abdominal tumors (hepatomegaly without associated icterus or other palpable tumor); (2) jaundice with or without hepatomegaly or; (3) undetermined ailments without palpable mass or icterus. Forty-six hepatomegaly (without icterus) patients had confirmed diagnosis by this method. When used by a trained echotomographist, the technique could make or confirm a diagnosis without subjecting the patient to further, possibly more dangerous, tests (e.g., aortography for diagnosis of aneurysms in the abdominal aorta). Echotomography helped determine to which organ a palpable mass belonged. In 90% of the cases echotomography determined whether it was a liquid or a solid tumor and its exact location. Studying 17 patients with retention jaundice, correctness of diagnosis was as follows: 36%, exact disgnosis; 41%, indirect information; 33%, failure to diagnose (60% appropriate answers). Echotomography should fall into the routine exam for jaundice. In the last 18% of the studied population when echotomography was used after an ultrasonic or radiologic test, precise diagnoses were established. In conclusion, it seems the best use for this technique is in the exploration of abdominal tumors, palpable or not, and in searching for collected fluids.

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See also, 7092, 7163, 7164, 7165, 7166, 7174, 7178, 7239, 7320, 7349, 7351, 7424, 7429, 7430, 7431, 7440, 7448, 7526, 7530, 7579, 7606, 7611, 7622, 7666, 7669, 7687, 7718, 7740, 7747, 7762, 7764, 7765, 7768, 7782, 7783, 7784, 7785, 7796, 7805, 7832, 7834, 7878, 7879, 7881, 7886, 7913, 7929, 7934, 7997.

# GASTROINTESTINAL DISEASES

## ESOPHAGUS

7069 MEASUREMENTS OF TRANSMUCOSAL POTENTIAL DIFFERENCE IN THE OESOPHAGUS, STOMACH AND DUODENUM UNDER ENDOSCOPIC CONTROL. *(E.)* Barbara, L.; Miglioli, M.; Di Febo, G.; Baldi, F.; Biasco, G.; Corinaldesi, R. (Dept. Internal Medicine, Gastroenterology, Univ. Bologna, Italy). *Rend. Gastroenterol.* 7(1):10-15, 1975.

Transmucosal potential differences were measured in organic lesions of the esophageal, gastric, and duodenal mucosa during endoscopy, and correlation of the results with the endoscopic and histologic appearance of the mucosa was attempted. Of 60 subjects, eight were apparently normal, seven had gastric ulcer, 14 had duodenal ulcer, four had gastric cancer, nine had chronic superficial gastritis, 15 had chronic atrophic gastritis, and one had dermatosclerosis. Exploratory electrodes were introduced *via* gastroduodenoscope and placed in direct contact with the mucosa, and reference electrodes were placed in contact with peripheral venous blood. At least 30 readings were taken per subject at various points (at least two readings per point). Three direct vision biopsy samples were taken from the stomach of each patient; basal and peak acid outputs were determined after pentagastrin stimulation. Controls showed mean potential differences for the esophagus, corpus and fundus, antrum and duodenum of -12.7, -45.48, -28.14, and -9.34 mV, resp. In the gastric ulcer patients, values were -10.56 mV at the level of the ulcer crater and -12.51 mV at the crater edge. Values of the corpus (-33.41 mV) and antrum (-19.0 mV) were significantly lower than control values. In the duodenal ulcer patients, values at the level of the crater were -4.58 mV and -5.3 mV at the crater edge. Values were also significantly lower than normal in the antrum and corpus. The dermatosclerosis patient had low values, except in the esophagus. Values were lowest at the angulus in which several non-bleeding erosions were present. The four gastric cancer patients had infiltrating and vegetating adenocarcinoma (ulcerated in one case) and infiltrating ulcerous carcinoma (two cases). Values were -13, -15, -5.5, and -6.5, resp. In the ulcerated zone, values went as low as -3 mV. Normal surrounding mucosa gave values ranging from -18.0 to -24.4. Histological examination showed grade 6 chronic atrophic gastritis in three cases, and grade 4 to 5 in the other case. No definite correlations of potential differences with endoscopic and histologic appearance were made.

7070 ESOPHAGEAL COLUMNAR EPITHELIAL β-GALACTOSIDASE AND β-GLUCURONIDASE. *(E.)* Berenson, M. M.; Herbst, J. J.; Freston, J. W. (Univ. Utah Coll. Medicine, 50 North Medical Drive, Salt Lake City, Utah 84132). *Gastroenterology* 68(6):1417-1420, 1975.

The activity of the lysosomal enzymes β-galactosidase and β-glucuronidase were compared in esophageal columnar, gastric fundic, and small intestinal epithelia. Esophageal biopsies were taken from four patients with midesophageal stricture and one patient with a deep esophageal ulcer. Gastric fundic and small intestinal tissue were obtained from patients undergoing endoscopy or peroral intestinal biopsy. All biopsy samples were homogenized. The mean β-galactosidase activity (as assayed using *p*-nitrophenyl-β-galactoside) in 10 gastric biopsies was 21.5 μmoles/g/hr; in eight small intestinal biopsies the mean was 28.9; in esophageal columnar epithelium the mean was 16.3. β-Galactosidase activity of gastric tissue was significantly less than the small intestine. Similarly, esophageal columnar epithelium was significantly less than small intestinal tissue, but did not differ from gastric tissue. The mean β-glucuronidase activity (as assayed with *p*-chloromercuribenzoate) in 10 gastric biopsies was 23.3 μmoles/g/hr; in seven small intestinal specimens the mean was 44.6; and in esophageal columnar epithelium the mean was 50.8. β-Glucuronidase activity in gastric tissue was significantly less than both small intestinal and esophageal columnar epthelium. Small intestinal and esophageal columnar epithelium did not differ significantly. It is concluded that esophageal columnar epithelium has enzyme characteristics which are dissimilar to both gastric fundic and intestinal tissue. This tends to corroborate previous findings of a structural and functional dissociation and suggests a metaplastic derivation.

7071 CAUSTIC STRICTURES OF THE OESOPHAGUS. *(E.)* Skene-Smith, H. (Dept. Radiology, Univ. Malaya, Kuala Lumpur, Malaysia). *Br. J. Radiol.* 48(572):646-648, 1975.

The radiological features of caustic strictures of the esophagus were studied in 16 females and six males aged 15-62 yr. The ages at caustic ingestion ranged from 1-45 yr, the ingestion being suicidal in nine cases. The structures were classified according to location (upper, middle, or lower third of the esophagus) and type (annular, short segment [less than 1/2 in. in length], and long segment). The lower third of the esophagus was involved in all the long segment strictures (16), but with sparing of the extreme distal portion in most cases. Irregularity of the stricture walls with an appearance similar to that reported in cases of intramural diverticulosis was a common finding (12 patients), but smooth strictures were also observed. Annular strictures (five) were noted with equal frequency in all portions of the esophagus, while short segment strictures (three) were noted only in the upper two-thirds. Of five long segment strictures involving the entire length of the esophagus, all had irregular walls. Dysphagia, chronic inflammation, and raised intraluminal pressure were present in patients with caustic strictures.

7072 THE ADVERSE EFFECT OF CHOCOLATE ON LOWER ESOPHAGEAL SPHINCTER PRESSURE. *(E.)* Wright, L. E.; Castell, D. O. (U.S. Naval Hosp., Philadelphia, Pa.). *Am. J. Dig. Dis.* 20(8):703-707, 1975.

The effect of chocolate on decreasing the lower esophageal sphincter (LES) pressure was studied in nine normal adult males using intraluminal end hole catheters. The responses to chocolate alone and to chocolate combined with agents known to increase LES pressure were evaluated. After basal LES pressure determinations, 120 ml of chocolate syrup mixed with 120 ml of distilled water was given p.o. to the subjects, who had fasted overnight. LES pressures were monitored for 1 hr. Mean pressure dropped from a basal level of 14.6 to a low of 7.1 mm Hg. On a subsequent day the subjects were given the same chocolate dose after basal recordings, and 15 min later were given 15 ml of a commercial antacid containing $Mg(OH)_2$-$Al(OH)_3$. Pressures were recorded for 1 hr after chocolate administration. Mean pressure dropped from a base of 13.3 to a low of 7.3 mm Hg at 15 min. On a third day the same dose of chocolate was given simultaneously with 25 mg of p.o. bethanechol. Four subjects were given 5 mg of bethanechol s.c. instead. With p.o. bethanechol, mean LES pressure dropped from a basal level of 18.4 to a low of 8.7 mm Hg at 15 min. With s.c. bethanechol, no decreases in pressure were observed; however, increases from a basal level of 16.5 to a peak of 25.3 mm Hg were seen at 30 min. Significant decreases in LES pressures after chocolate ingestion was demonstrated, confirming previous results by these authors. The results imply that neither antacid nor p.o. bethanechol administration reverses the action of chocolate in lowering LES pressure. However, s.c. bethanechol did reverse the LES pressure-lowering effect of chocolate.

7073 EFFECT OF PROSTAGLANDIN $E_2$ ON ESOPHAGEAL MOTILITY IN MAN. *(E.)* Mukhopadhyay, A.; Rattan, S.; Goyal, R. K. (Baylor Coll. Medicine, Houston, Tex. 77025). *J. Appl. Physiol.* 39(3):479-481, 1975.

The effects of prostaglandin $E_2$ ($PGE_2$) on upper and lower esophageal sphincter pressures and on esophageal motility were studied in 12 normal adults, using intra-esophageal catheters. The luminal pressures were measured with three water filled side hole catheters glued together; the holes were 2.5 cm apart. The middle hole was placed at the sphincter, and pressures were recorded at 1 min intervals. A solution of 750 µg of $PGE_2$ in 150 ml of 5% dextrose was given by continuous i.v. infusion in varying, randomized doses over 5 min (doses were 30 min apart). The effect on lower esophageal sphincter (LES) pressure was measured in five subjects. The mean percent pressure fall at 5 min was 8.5, 21.3, 33.0, 61.6 and 52.0 for doses of 0.05, 0.1, 0.2, 0.4 and 0.8 µg/kg/min, resp. The effect on upper esophageal sphincter (UES) pressure was measured in three subjects, using doses of 0.4 and 0.8 µg/kg/min; no significant fall in pressure was observed. Peristalsis was studied with the catheter openings 10 cm apart so as to position them in the upper, middle and lower parts of the esophagus; peristalsis was initiated by dry swallows. Five subjects were studied using continuous infusion of $PGE_2$. Resting pressures were unaffected. The amplitude of contractions in the upper portion was unchanged, but was "significantly reduced" in the lower and middle esophagus. The speed of peristalsis was 4.9 cm/sec *versus* 3.6 cm/sec in the upper half and 5.4 *versus* 6.2 cm/sec in the lower half during dextrose infusion and $PGE_2$ infusion, resp. It is suggested that $PGE_2$ may selectively influence smooth muscle motor function in the esophagus. $PGE_2$ caused a dose-dependent reduction in LES pressure but did not affect UES pressure. The authors also suggest that $PGE_2$ reduces the amplitude of peristaltic contractions in the lower part of the esophagus.

7074 PRESSURE, TENSION, AND FORCE OF CLOSURE OF THE HUMAN LOWER ESOPHAGEAL SPHINCTER AND ESOPHAGUS. *(E.)* Biancani, P.; Zabinski, M. P.; Behar, J. (Yale Univ. Sch. Medicine, New Haven, Conn. 06510). *J. Clin. Invest.* 56(2):476-483, 1975.

The influence of probe diameter on lower esophageal sphincter (LES) pressure and force of closure was studied, and the tension developed by the human LES and esophageal circular muscle was examined *in vivo*. Pressure and diameter characteristics were determined in 14 normal controls and in 19 patients with reflux esophagitis by the separate and random introduction of single motility catheters, attached to a plexiglas "olive" (0.25-1.0 cm in diameter). LES pressure in normal subjects was higher with the 0.25 cm olive, lower with the 0.5 cm olive, and gradually increased with the 0.75 and 1.0 cm olives. LES pressure in esophagitis patients remained low at all olive diameters. LES pressures were significantly different when measured pressures of competent and incompetent sphincters were compared at various probe diameters. Competent sphincters showed pressure differences only with probes between 0.50 and 0.75 cm. LES pressure increased at all probe diameters after successful fundoplication. Administration of the autocholinergic Pro-Banthine caused the pressure-diameter curves for competent sphincters to approximate those of patients. Urecholine stimulated pressures of incompetent sphincters and the pressure-diameter curves became similar in magnitude and shape to those of competent sphincters. Peak esophageal pressures in response to swallowing increased with larger probe diameters. The length-tension relation of the circular muscle increased continuously as the diameter increased for both competent and incompetent sphincters. Force and tension curves were similar in both types of sphincter. It is concluded that competent and incompetent sphincters have distinctly different pressure-diameter characteristics.

7075 CORRELATION OF LOWER ESOPHAGEAL SPHINCTER PRESSURE AND SERUM GASTRIN LEVEL IN MAN. *(E.)* Wright, L. F.; Slaughter, R. L.; Gibson, R. G.; Hirschowitz, B. I. (Veterans Administration Hosp., Birmingham, Ala. 35233). *Dig. Dis.* 20(7):603-606, 1975.

The relation between lower esophageal sphincter (LES) pressure and simultaneous serum gastrin level was studied in 35 consecutive patients. Of these, seven served as controls; nine had gastroesophageal reflux and hiatus hernia (Group I), and the remaining 19 had no symptoms of reflux (Group II). Group II included eight patients with dysphagia, seven with chest pain, three with abdominal pain and one with persistent

vomiting. Hiatus hernia was present in five Group II patients (IIA) and was not present in 14 Group II patients (IIB). The LES pressure of Group I was significantly lower (9.7 cm $H_2O$) than that of groups IIA (36.8) and IIB (25.6). The serum gastrin levels were not significantly different (129, 74 and 116 pg/ml, resp.). There was no correlation between individual LES pressure and individual serum gastrin level. In patients with abnormalities either of serum gastrin levels or the LES, there was no relation between these two factors. It is concluded that gastrin has no major physiologic role in the maintenance of sphincter tone.

7076 COMPARATIVE EFFECTS OF METOCLOPRAMIDE AND BETHANECOL ON LOWER ESOPHAGEAL SPHINCTER PRESSURE IN REFLUX PATIENTS. *(E.)* McCallum, R. W.; Kline, M. M.; Curry, N.; Sturdevant, R. A. L. (Veteran's Admin. Wadsworth Hosp. Cent., Los Angeles, Calif.). *Gastroenterology* 68(5):1114-1118, 1975.

The effects of p.o. metoclopramide (10 and 20 mg), bethanecol (25 mg) and placebo on lower esophageal sphincter (LES) pressure and serum gastrin concentration were compared in 15 male patients with symptoms of gastroesophageal reflux. The LES pressure was measured by a rapid pull-through technique in patients after an overnight fast. The mean basal LES pressure on the four study days ranged from 5.4 to 5.6 mm Hg. Each drug produced a significant increase in pressure compared with the placebo. Metoclopramide at 20 mg produced a significantly higher pressure from 30-60 min after ingestion than either the 10 mg dosage of metoclopramide or bethanecol. LES pressures after 10 mg metoclopramide or bethanecol were not significantly different. The peak of LES pressures for the 15 subjects ranged from 4.3-15.0 mm Hg for placebo (mean, 9.2); 3.0-19.3 mm Hg for 10 mg metoclopramide (mean, 11.9); 8.4-23.5 mm Hg for 20 mg metoclopramide (mean, 15.8); and 4.5-19.5 mm Hg for bethanecol (mean, 11.7). The peak change in LES pressure from basal and the peak LES pressure were each significantly correlated with the basal LES pressure after 20 mg metoclopramide. Only the peak LES pressure was significantly correlated with basal pressure after 10 mg metoclopramide. There was no correlation between these two parameters and the basal LES pressure after bethanecol. Mean serum gastrin concentrations were not altered by any drug. Bethanecol produced statistically significant but small decreases in diastolic blood pressure and in pulse rate after 40 min. These data confirm previous findings of a correlation between basal LES pressure and rise in pressure after metoclopramide. It is suggested that metoclopramide be considered in a clinical trial in the treatment of gastroesophageal reflux.

7077 CONSERVATIVE SURGICAL TREATMENT OF REFLUX ESOPHAGITIS AND ESOPHAGEAL STRICTURE. *(E.)* Herrington, Jr., J. L.; Wright, R. S.; Edwards, W. H.; Sawyers, J. L. (Vanderbilt Univ. Medical Cent., Nashville, Tenn.). *Ann. Surg.* 181(5):552-566, 1975.

Operative dilatation accompanied by an antireflux precedure was used in the treatment of 17 consecutive patients with advanced esophageal stricture and reflux esophagitis during a 3-yr period. The patients included nine men and eight women, aged 46-90 yr. Symptoms of reflux esophagus were present from 18 months to 30 yr. Preoperative procedures included barium examination of the esophagus and upper gastrointestinal tract, cinefluoroscopy, and esophagoscopy with biopsy. The stricture was of the longitudinal type in 10 patients and a short, distal, and annular stricture was found in the remaining seven cases. Simultaneous ante- and retrograde dilatation was carried out at operation in all cases. A Nissen fundoplication was performed in 15 patients, one had a Hill posterior gastropexy, and the remaining patient had a Belsey repair. Of the 17 patients, 16 survived surgery, and were studied postoperatively. Of these 16, one died soon after surgery of cardiovascular complications. Excellent clinical results were obtained in 11 cases, with no abdominal discomfort and no dietary restrictions. Mild and intermittent abdominal discomfort was experienced in four patients. During the postoperative follow-up, six patients required from one to three esophageal dilatations during the early postoperative period, and two patients with severe longitudinal strictures required monthly dilatations up to one yr. It is suggested that this simplified surgical approach directed toward correction of reflux and preservation of organ tissue should be attempted before more radical surgery.

7078 EFFECT OF FUNDOPLICATION ON THE LOWER ESOPHAGEAL SPHINCTER. *(E.)* Bowes, K. L.; Sarna, S. K. (Dept. Surgery, Univ. Alberta, Edmonton, Alberta T6G 263, Canada). *Can. J. Surg.* 18(4):328-334, 1975.

Manometric measurements were made of the lower esophageal sphincter (LES) before and after fundoplication, to determine whether the alleviation of symptoms after this procedure can be attributed to either the creation of or improved function of a physiologic sphincter. A modified Nissen fundoplication was performed in 26 patients with heartburn and regurgitation; 20 of these had hiatus hernia. Manometry was performed before and 3 months after surgery; cadaver studies were also made. Complete recovery was noted in 24 patients. Symptoms reoccurred in one patient after 3 months, and in another, after 26 months. The common cavity test (simultaneous increases in gastric and esophageal size during abdominal compression) was positive in 22 patients before surgery, and in only the two with recurring symptoms postoperation. The acid perfusion test was positive in 25 patients before fundoplication (mean time, 267 sec). The time required for reproduction of these results was increased in all 26 after surgery, and in seven, results were negative (mean time, 616 sec; $P < 0.01$). Resting LES pressure increased from a mean of 12.6 presurgery to a mean of 16.5 cm $H_2O$ postsurgery. An increase in LES pressure was seen in 15 patients, there was no change in four, and in seven, the pressure fell. It is suggested that increases in sphincter pressure after fundoplication are secondary to extrinsic narrowing, and do not indicate creation of a physiologic sphincter.

7079 MEDICAL AND SURGICAL MANAGEMENT OF REFLUX ESOPHAGITIS: A 38-MONTH REPORT ON A PROSPECTIVE CLINICAL TRIAL. *(E.)* Behar, J.; Sheahan, D. G.; Biancani, P.; Spiro, H. M.; Storer, E. H. (Veterans Admin. Hosp., West Haven, Conn., 06516). *N. Engl. J. Med.* 293(6):263-268, 1975.

A controlled prospective and randomized study was performed to compare posterior gastropexy with anterior fundoplication, and to determine factors influencing selection of patients for medical or surgical treatment. The patients studied included 51 men with symptoms of chronic reflux and objective evidence of reflux esophagitis for 2 yr or more. Of these, 31 were randomized into groups of surgical (15) and medical patients (16); the remaining 20 were non-randomized patients receiving medical treatment. Surgical treatment consisted of a Belsey Mark IV alone in ten men, and this combined with the Hill method in five. Medical treatment consisted of head elevation (15 cm), bland diet, weight reduction and liquid antacids. All patients were followed for 20 to 46 mo. After operation, 11 of 15 patients had no symptoms of reflux, with a negative acid infusion test, except for one patient on one occasion. The esophagus appeared normal at endoscopy. Only three patients in the randomized medical group and four in the non-randomized group became asymptomatic with a negative acid infusion test and normal esophagus at esophagoscopy. The correlation of symptomatic and objective responses to both surgical and medical management was good. Patients with excellent to good response to surgical treatment had an increase in resting sphincter pressures persisting for up to 3 yr ($P < 0.001$). The response to medical management correlated well with the severity of the esophagitis and the degree of sphincter incompetence. These results indicate that at least during the first 3 yr, surgical treatment is more effective than current medical management in patients with severe reflux symptoms.

7080 HISTOLOGIC ABNORMALITIES IN REFLUX ESOPHAGITIS. *(E.)* Behar, J.; Sheahan, D. C. (VA Hosp., West Haven, Conn.). *Arch. Pathol.* 99(7): 387-391, 1975.

Esophageal mucosal response to gastroesophageal reflux was studied in patients with heartburn with normal endoscopic appearance of the esophageal mucosa. Histological findings were compared in 15 control patients without gastroesophageal symptoms and 40 consecutive male patients with heartburn (postprandial, substernal burning pain, or postural changes), with or without regurgitation or dysphagia, for at least two yr prior to admission. All subjects had upper gastrointestinal roentgenograms, esophagoscopy, acid perfusion tests, esophageal manometry, intraesophageal pH study, maximal histamine test, and multiple esophageal biopsies. Heartburn was the most prominent symptom in 20 patients with mild esophagitis and four of these also had regurgitation. The radiologic appearance of the esophagus was normal in these patients. The mean lower esophageal sphincter pressure was significantly lower than that of the controls. Patients with severe esophagitis had heartburn (95%), regurgitation (65%), dysphagia (40%), and low-grade bleeding (25%): all showed either mucosal friability or acute or chronic ulcerated lesions. Histologic examinations showed lymphoid aggregates in 50% of controls, and in 85% and 65%, resp., of patients with severe and mild esophagitis. Neutrophils were observed in 5% and 40%, resp., but were absent in control samples. Patients with mild and severe esophagitis had papilla higher than 50% of the mucosal thickness in 95% and 100%, resp., and a basal zone more than 15% of mucosal thickness in 95% and 94%, resp. Both abnormalities were seen in patients with mild and severe esophagitis in at least two biopsy specimens in 95% and 94%, resp. Of the controls, 47% had elongated papillae and 13% had a hyperplastic basal zone; none had both abnormalities together. These results confirm the validity of the use of the simultaneous presence of elongated papilla in the lamina propria and basal cell hyperplasia of the squamous epithelium in at least two biopsy specimens as diagnostic criteria of reflux esophagitis.

7081 ACHALASIA AND ESOPHAGEAL CARCINOMA. STUDIES IN EARLY DIAGNOSIS FOR IMPROVED SURGICAL MANAGEMENT. *(E.)* Carter, R.; Brewer, L. A., III. (Dept. Surgery, Univ. California, Irvine, Calif.) *Am. J. Surg.* 130(2):114-120, 1975.

Four patients with achalasia and carcinoma were studied, and 221 cases of this association were reviewed in the literature to determine salient features of early diagnosis. The average age at the appearance of esophageal carcinoma in achalasia patients was 48 yr, in contrast to 64 yr for esophageal cancer in general. The average duration of the achalasia was 17 yr. Men were affected three times as often as women; this is a reversal of the frequent prevalence of achalasia in women. The most common site of origin was the middle third of the esophagus. The earliest signs were unexplained gastrointestinal bleeding or anemia. Other presenting symptoms were: recurrence of dysphagia, blood-tinged regurgitation, retrosternal or back pain, excessive weight loss, development of clubbing, and unexplained general deterioration. The lesions were often bulky, polypoid and largely epidermoid; they were easily missed on esophagography and esophagoscopy due to retention of food, and were rarely resectable, resulting in poor prognosis. There were indications that stasis esophagitis is premalignant. Early myotomy to relieve obstruction may be preventative, but once megaesophagus has developed, obstruction is usually permanent. Thorough cleansing of the esophagus prior to esophagography and esophagoscopy is emphasized, and esophageal washings, endoscopic cytologic study and biopsy are recommended as highly accurate diagnostic procedures. It is concluded that diagnosis must be early if curative resection is to be possible.

7082 PROBABLE PATHOGENIC RELATION BETWEEN SYSTEMIC MASTOCYTOSIS AND REFLUX ESOPHAGITIS. *(Sp.)* Garrido, M.; Calvo Cano, M.; Villegas, A.; Gonzalez, G. (Clinical Hosp., Faculty Medicine, Madrid, Spain). *Rev. Clin. Esp.* 135(1):73-78, 1974.

7083 THERAPY IN BLEEDING FROM HIATUS HERNIA. *(Ger.)* Hiemeyer, V. (no affiliation given). *Thromb. Diath. Haemorrh.* (Suppl. 61):111-116, 1975.

7084 PATHOLOGICAL AND ANATOMICAL CONSIDERATIONS OF ESOPHAGEAL BLEEDING ESPECIALLY IN REGARD TO VARICES. *(Ger.)* Gusek, W. (no affiliation given). *Thromb. Diath. Haemorrh.* (Suppl. 61):11-23, 1975.

7085 THE PATHOLOGY OF THE HIATUS HERNIA AS A SOURCE OF GASTROINTESTINAL BLEEDING. *(Ger.)* Mitschke, H. (no affiliation given). *Thromb. Diath. Haemorrh.* (Suppl. 61):91-102, 1975.

7086 HEMOSTATIC CONDITIONS AND ESOPHAGEAL VARICES IN VINYLCHLORIDE-RELATED DISEASE. *(Ger.)* Bachner, U.; Etzel, F.; Lange, C. E.; Marsteller, H. J.; Veltmann, G. (no affiliation given). *Thromb. Diath. Haemorrh.* (Suppl. 61):67-73, 1975.

7087 PATHOGENESIS AND FREQUENCY OF BLEEDING FROM HIATUS HERNIA. *(Ger.)* Tilsner, V. (no affiliation given). *Thromb. Diath. Haemorrh.* (Suppl. 61):107-110, 1975.

7088 BENIGN TUMOURS OF THE ESOPHAGUS. *(Fr.)* Forster, E.; Cinqualbre, J.; Tongio, J.; Olive, B.; Weill-Bousson (Clinique chirurgicale A, C.H.U., Hopital civil, 67000 Strasbourg, France). *Rev. Practicien* 24(27):2447-2468, 1974.

7089 ESOPHAGEAL CARCINOMA. *(Por.)* Junior, A.; Braga, A.; Cardoso, V. (Faculty Medicine, Univ. Porto Servico, Brazil). *J. Med. (Lisboa)* 87(1644):237-246, 1975.

7090 LEIOMYOSARCOMA OF THE ESOPHAGUS. *(Ger.)* Schafer, V. W. (Mannheim Faculty Clinic Medicine, Univ. Heidelberg, Heidelberg, Germany). *Fortschr. Gerb. Roentgenstr. Nuklearmed.* 122(2):169-170, 1975.

7091 FOLLOW-UP OF ESOPHAGEAL CANCERS TREATED AT THE FRANCOIS BACLESSE CENTER SINCE 1964. *(Fr.)* Roussel, A. (Centre Francois Baclesse, Caen, France). *Ouest Medical* 28(6):381-386, 1975.

7092 CLINICAL, ENDOSCOPIC AND MORPHOLOGIC STUDIES IN FOUR PATIENTS WITH COLUMNAR EPITHELIUM LINING THE DISTAL TWO-THIRDS OF THE ESOPHAGUS. *(E.)* Gibb, S. P.; Mallari, R.; Haggitt, R.; Ellis, F. H. (Lahey Clin. Found., Boston, Mass.). *Gastroenterology* 68(4):1029, 1975.

7093 GASTRIC RUGAL HYPERTROPHY IN HIATAL HERNIA SAC (SENTINEL FOLD), A POSSIBLE ENDOSCOPIC SIGN OF GASTROESOPHAGEAL REFLUX. *(E.)* Butler, M. L.; Walta, D. C.; Johnson, L. F. (Tripler Army Med. Cen., Honolulu, Hawaii). *Gastroenterology* 68(4):1022, 1975.

7094 ACUTE ESOPHAGEAL DAMAGE FROM ONE BRAND OF TETRACYCLINE TABLETS. *(E.)* Burke, E. L. (St. Paul-Ramsey Hosp., St. Paul, Minn.). *Gastroenterology* 68(4):1022, 1975.

7095 ACHALASIA: A RETROSPECTIVE CORRELATION. *(E.)* Biederman, M. A.; Rinaldo, J. A.; Gelzayd, E. (Providence Hosp., Southfield, Mich.). *Gastroenterology* 68(4):1019, 1975.

7096 ESOPHAGEAL CARCINOMA ARISING ON BARRETT'S EPITHELIUM. *(E.)* Alves, M. A.; Ellis, F. H.; Haggitt, R.; Colcher, H. (Lahey Clin. Found., Boston, Mass.). *Gastroenterology* 68(4):1017, 1975.

7097 A HISTOPATHOLOGIC DEMONSTRATION OF THE ASSOCIATION OF GASTRITIS AND REFLUX ESOPHAGITIS. *(E.)* Volpicelli, N. A.; Yardley, J. H.; Hendrix, T. R. (Johns Hopkins Univ. Sch. Med., Baltimore, Md.). *Gastroenterology* 68(4):1007, 1975.

7098 ABSENCE OF ACID SENSITIVITY IN PATIENTS WITH BENIGN PEPTIC ESOPHAGEAL STRICTURES. *(E.)* Volpicelli, N. A.; Bedine, M. S.; Hendrix, T. R. (Johns Hopkins Univ. Sch. Med., Baltimore, Md.). *Gastroenterology* 68(4):1007, 1975.

7099 ALKALINE SENSITIVE REFLUX ESOPHAGITIS. *(E.)* Vela, A. R.; Akdamar, K. (Louisiana State Univ. Sch. Med., New Orleans, La.). *Gastroenterology* 68(4):1005, 1975.

7100 OBSTRUCTIVE JAUNDICE SECONDARY TO PARA-ESOPHAGEAL HERNIATION. *(E.)* Sicular, A.; Klion, F. M.; Werther, J. L. (Mt. Sinai Sch. Med., New York, N.Y.). *Gastroenterology* 68(4):987, 1975.

7101 "INFORMED CONSENT" FOR ESOPHAGO-GASTROSCOPY: AN APPRAISAL OF PATIENTS' REACTIONS. *(E.)* Roling, G. T.; Pressgrove, L. W.; Keeffe, E. B.; Raffin, S. B. (Naval Regional Med. Cent., Oakland, Calif.). *Gastroenterology* 68(4):975, 1975.

7102 HYPERCALCEMIA (HYCA) IN SQUAMOUS CELL CARCINOMA OF THE ESOPHAGUS (SEC). *(E.)* Ravry, M. J. R. (Univ. Puerto Rico Sch. Med., San Juan, Puerto Rico). *Gastroenterology* 68(4):971, 1975.

7103 ESOPHAGEAL MOTOR ABNORMALITY DURING HICCUP. *(E.)* Mukhopadhyay, A. K.; Graham, D. Y. (Baylor Coll. Med., Houston, Texas). *Gastroenterology* 68(4):962, 1975.

7104 FAILURE OF GASTRIN ANTISERUM TO INFLUENCE LOWER ESOPHAGEAL SPHINCTER PRESSURE: A DOUBLE BLIND CONTROLLED STUDY. *(E.)* Goyal, R. K.; McGuigan, J. E. (Univ. Texas Southwestern Med. Sch., Dallas, Tex.). *Gastroenterology* 68(4):951, 1975.

7105 EFFECT OF ORAL 16,16 DIMETHYL PROSTAGLANDIN $E_2$ ($PGE_2$) ON THE LOWER ESOPHAGEAL SPHINCTER IN MAN. *(E.)* McCallum, R. W.; Ippoliti, A. F.; Sturdevant, R. A. L. (Wadsworth VA Hosp., Los Angeles, Calif.). *Gastroenterology* 68(4):949, 1975.

7106 STUDIES ON THE MECHANISM OF THE LOWER ESOPHAGEAL SPHINCTER PRESSURE RESPONSE TO ALKALI INGESTION IN MAN. *(E.)* McCallum, R. W.; Kline, M. M.; Sturdevant, R. A. L. (Wadsworth VA Hosp., Los Angeles, Calif.). *Gastroenterology* 68(4):948, 1975.

7107 BARRETT'S ESOPHAGUS—DIAGNOSIS BY TECHNITIUM SCAN. *(E.)* Mangla, J. C.; Brown, M. (Monroe Community Hosp., Rochester, N.Y.). *Gastroenterology* 68(4):943, 1975.

7108 BARRETT'S ESOPHAGUS--CLINICAL AND PHYSIOLOGICAL CHARACTERISTICS. *(E.)* Mangla, J. C.; Desbaillets, L. G.; Schenk, E.; Guarasci, G.; Turner, M. D.; Kubasik, N. P. (Monroe Community Hosp., Rochester, N.Y.). *Gastroenterology* 68(4): 942, 1975.

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7112 THE INCIDENCE OF ESOPHAGITIS ASSOCIATED WITH OTHER GASTROINTESTINAL DISEASES. *(Ger.)* Arendt, R.; Hauzeur, F. (Bereich Medizin, Universitat Rostock, DDR-25 Rostock, Ernst-Heydemann-Strasse, Germany). *Dtsch. Z. Verdau. Stoffwechselkr.* 34(5/6):251-257, 1974.

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7114 SAINT'S TRIAD: IS IT A PATHOLOGICAL ENTITY? (17 CASES). *(Fr.)* Bertrand, J.; Le Goarant, P. (No affiliation given). *Rev. Fr. Gastroenterol.* (108):15-16, 19-20, 22, 1975.

7115 STUDYING HIATAL HERNIAS WITH AMPLIFIED FLUOROSCOPY. *(Fr.)* Ecarlat, B.; Dartigues, P. (Faculte Medecine Tours, C.H.R. Bretonneau, 2, bd Tonnelle, 37000 Tours, France). *Rev. Fr. Gastroenterol.* (107):25-28, 31-32, 35-39, 1975.

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7120 GENERAL SEMIOLOGY AND EXPLORATION OF THE OESOPHAGUS. *(Fr.)* Mouchet, A.; Guivarc'h, M. (Dept. General Gastrointestinal Surgery, C. M. C. Foch, Suresnes, France). *Rev. Prat.* 24(27):2382-2404, 1974.

7121 CANCER OF THE OESOPHAGUS. TREATMENT. *(Fr.)* Fekete, F.; Froissard, P. (Clinical Surgery, Beaujon Hosp., Clichy, France). *Rev. Prat.* 24(27):2423-2446, 1974.

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7123 OESOPHAGUS ULCERS. *(Fr.)* Maillard, J. N.; Flamant, Y. (Faculty Medicine, Dijon, France). *Rev. Prat.* 24(27):2491-2512, 1974.

7124 ESOPHAGEAL ACHALASIA ASSOCIATED WITH GASTRIC CARCINOMA: LACK OF EVIDENCE FOR WIDESPREAD PLEXUS DESTRUCTION. *(E.)* Shulze, K. S.; Goresky, C. A.; Jabbari, M.; Lough, J. O. (Montreal General Hosp., Quebec, Canada). *Can. Med. Assoc. J.* 112(7):857-863, 1975.

## ESOPHAGUS

7125 CLINICAL STAGING SYSTEM FOR CARCINOMA OF THE ESOPHAGUS. *(E.)* Anonymous (Amer. Joint Committee for Cancer Staging and End Results Reporting, 55 E. Erie St., Chicago, Ill. 60611). *Cancer J. Clin.* 25(2):50-57, 1975.

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7127 ESOPHAGEAL PAPILLOMATOSIS AND ACANTHOSIS NIGRICANS. *(Fr.)* Heully, F.; Gaucher, P.; Weber, M.; Jeanpierre, R.; Laurent, J.; Kremer, B.; Beurey, J. (Brabois Hosp., Vandoeuvre, France). *Ann. Gastroenterol. Hepatol.* 10(6):487-490, 1974.

7128 GASTRO-OESOPHAGEAL ACID REFLUX. METHOD FOR 12-HOUR CONTINUOUS RECORDING OF OESOPHAGEAL pH WITH ANALYSIS OF RECORDS. *(E.)* Beosby, S.; Madsen, T.; Sorensen, H. R. (Dept. Thoracic and Cardiovascular Surgery, Odense Sygehus, Odense, Denmark). *Scand. J. Gastroenterol.* 10(4):379-384, 1975.

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7130 ABNORMAL DUODENAL LOOP IN PATIENTS WITH SLIDING ESOPHAGEAL HIATAL HERNIA—STUDIES ON INTRAGASTRIC PRESSURE AND GASTROCOLIC REFLEX. *(E.)* Thommesen, P. (Central Hosp., Randers, Denmark). *Fortschr. Rontgenstr.* 121(6):749-760, 1974.

7131 PHARMACOLOGY OF THE ESOPHAGEAL MOTOR FUNCTION. *(E.)* Christensen, J. (Univ. Iowa Hosp. and Clinics, Iowa City, Iowa, 52242). *Annu. Rev. Pharmacol.* 15:243-258, 1975.

7132 DIFFUSE LEIOMYOMATOSIS OF THE ESOPHAGUS. A CASE REPORT AND REVIEW OF THE LITERATURE. *(E.)* Fernandes, J. P.; Mascarenhas, M. J.; da Costa, J. C.; Correia, J. P. (Santa Maria Hosp., Lisbon 4, Portugal). *Am. J. Dig. Dis.* 20(7):684-690, 1975.

7133 CARCINOMA OF THE OESOPHAGUS: PREOPERATIVE IRRADIATION FOLLOWED BY PLANNED RESECTION FOR LESIONS IN THE MIDDLE AND LOWER THIRDS—AN INTERIM REPORT. *(E.)* Smith, F. S.; Gibson, P.; Nicholls, T. T. (Royal Perth Hosp., Box X2213, Perth, Western Australia 6001). *Aust. N.Z. J. Surg.* 45(2):176-178, 1975.

See also, 6700, 6721, 6985, 6987, 7004, 7008, 7022, 7048, 7203, 7208, 7741, 7860, 7871, 7876, 7910.

## STOMACH

7134 GASTRIC POLYPECTOMY. *(E.)* Seifert, E.; Elster, K. (Medizinische Hochschule, Hannover, Germany). *Am. J. Gastroenterol.* 63(6):451-456, 1975.

The histological findings of direct biopsy were compared with those of total excision in 75 gastric polyps removed by electroresection through a fiberscope, and a new histological classification of gastric polyps was developed based on 244 gastric polyps in 161 patients. The polyps were recovered *in toto* by suction or special grasper forceps. In 53 of 75 cases, discrepancies of histologic diagnosis were observed. The most frequent cause of discrepancy was the mixed form of epithelial polyp. Superficial excision very often yielded a pattern of foveolar hyperplasia, suggesting the biopsy was taken from a hyperplastic polyp. The hyperplastic gastric polyp, occurring in 14.8% of the patients with a single polyp, corresponded to the hyperplastic colonic polyp in structure and pathogenesis. Its histological criterion was the presence of finger-like, elongated crests and correspondingly deep stretched pits, resulting in a somewhat papillary structure. The adenomatous gastric polyp, occurring in 47.7% of patients with solitary gastric polyps, revealed structural peculiarities which exclude a pathogenetic relation with the adenomatous colonic polyp. This polyp apparently has an intermediate position between hyperplasia and adenoma. The real adenomatous polyp, a true adenoma, was very rare and occurred in only 7.4% of the cases with solitary polyps. Six patients had generalized gastric polyposis. In 92 sites of resections, out of a total of 176 sites, healing was complete at the end of one wk. The following classification of gastric polyps is suggested: focal hyperplasia, hyperplasiogenic polyp, adenoma, proliferation of glandula neck with epithelial atypia, and early gastric cancer types I and IIA. The findings suggest that gastric polyps are generally not precancerous lesions though cancer does occur in rare cases. Neoplasia does not appear to be related to number of polyps, to site, but rather presumably to inherent biologic activity.

7135 FIBEROPTIC ENDOSCOPY IN TREATMENT OF CORROSIVE INJURY OF THE STOMACH. *(E.)* Chung, R. S. K.; DenBesten, L. (Veterans Administration Hosp., Iowa City, Iowa 52240). *Arch. Surg.* 110(6):725-728, 1975.

Three patients with corrosive injury of the esophagus and/or stomach were studied by multiple endoscopies to document the natural history of corrosive injury. A 47-yr-old alcoholic who drank 355 ml of 23% HCl developed intense abdominal pain and vomited dark red mucoid material. Physical examination revealed erythema of the palate and posterior pharynx with tenderness of the epigastrium. Endoscopy showed hemorrhagic erosion of the esophagus. The patient was treated with nasogastric suction, i.v. fluids and antibiotics and steroids. Endoscopy on the sixth day revealed a 3 cm length of mild esophageal erythema and gangrenous changes in the gastric antral mucosa. The patient was operated, and full-thickness necrosis was observed on the serosa, which extended to the transverse mesocolon. Gastric antrectomy with Billroth I reconstruction was followed by uneventful recovery. A 45-yr-old male who drank 59 ml of 30% NaOH vomited red blood and had melena 4 days after ingestion. Endoscopy on the fifth day revealed extensive hemorrhagic areas in the stomach, most marked in the antrum. He was treated similarly to the first patient. Two weeks post-injury, repeat endoscopy showed the antrum to be scarred and edematous. The patient was treated surgically and recovered. A 45-yr-old male ingested 10 g of mercury bichloride and 75 mg of valium. Presenting symptoms were as above. Two weeks post-injury, endoscopy revealed erosions of the gastric mucosa most severe in the antrum. Forty days post-injury, the mucosa had improved and granulations were noted. The patient made an uneventful recovery. The acute stage involves hemorrhagic erosions and ulcerations of the mucosa, which gradually heal and fibrosis with decreased vascularity results, while gangrenous mucosa suggests full-thickness necrosis.

7136 MEASUREMENT OF IMMUNOREACTIVE GASTRIN IN GASTRIC MUCOSA. *(E.)* Malmstrom, J.; Stadil, F. (Rigshospitalet, Copenhagen, Denmark). *Scand. J. Gastroenterol.* 10(4):433-439, 1975.

A method for measuring gastrin in gastric mucosa was developed, and the distribution of gastrin in the stomach of pig, dog, cat, rabbit, and man was examined. Biopsy specimens were frozen, boiled, and homogenized. The gastrin content was measured by radioimmunoassay. Monoiodinated 125-I-SHG (synthetic human gastrin) was used as tracer. Gastrin was found in measurable amounts in all specimens examined, but the content was considerably higher inside the antrum. The highest concentration was found in man. In corpus biopsies from 21 subjects, the gastrin content was 78 ng/g mucosa. The border between the corpus and the gastrin rich antrum was sharp, but apart from this no particular pattern of gastrin distribution was apparent in the two parts of the stomach. Duodenal ulcer patients, control patients, and normal subjects had high gastrin content in the stomach, whereas patients with gastric carcinoma and gastric ulcers had low. In 44 patients with duodenal ulcer, the antral gastric concentration was 21.3 μg Eq/g mucosa; in 15 patients with prepyloric ulcer, 23.0; in 10 patients with gastric ulcer, 5.9; and in 16 patients with gastric carcinoma, 7.9. The control group consisted of 10 healthy volunteers and 12 patients with minor abdominal complaints. Mean antral gastrin concentrations were 28.1 and 20.7, resp. Human mucosa contained 8-10 times more gastrin than in dogs and 4-8 times more than in pigs. The results agree with previous studies that antral gastrin content in duodenal ulcer patients and normal subjects does not differ and clearly indicates that gastrin content is not increased in duodenal ulcer.

7137 INTRAMURAL INJECTION OF ETHANOL UNDER DIRECT VISION FOR THE TREATMENT OF PROTUBERANT LESIONS OF THE STOMACH. *(E.)* Otani, T.; Tatsuka, T.; Kanamaru, K.; Okuda, S. (Center Adult Diseases, 3-3, Nakamichi 1-chome, Higashinari-ku, Osaka 537, Japan). *Gastroenterology* 69(1):123-129, 1975.

Local injection of ethanol was used to remove gastric polyps and wide-based polypoid growths in dogs. This method was also used in the treatment of early gastric cancer in poor-risk patients. Ulcers were produced in mongrel dogs by bleomycin, mitomycin, OK-432, acetic acid and ethanol by intramural injection of various concentrations. Ethanol in a concentration of 95% was the most effective, producing immediate changes in the gastric mucosa which delineated the size of the ulcer. The depth of ulceration could be controlled and the ulcer healed readily. Gastroscopic injection with 95% ethanol was used to treat 54 patients with pedunculated (21 patients), narrow-based sessile (eight) and wide-based sessile polypoid lesions (25). Of 54 cases, 35 were hyperplastic or adenomatous polyps, 17 showed atypical hyperplasia and two had early gastric cancer, type II a. Complete eradication was confirmed by biopsy in all patients with atypical hyperplasia and early gastric cancer. Of 54 cases, treatment was not successful in three: one with wide-based sessile growth and two with pedunculated polyps. Complete healing with scar formation was seen in 43 cases within 6 weeks. It is concluded that polyp removal by intramural injection of ethanol is appropriate for the management of early gastric cancer in low-risk patients.

7138 INTRAMURAL VASCULAR CHANGES IN STOMACHS REMOVED BECAUSE OF BLEEDING—AS VISUALIZED WITH INDIAN INK—. *(E.)* Nagao, F.; Ikeuchi, J.; Kjijma, M.; Narikawa, T. (Jikei Univ. Sch. Medicine, Japan). *Jikeikai Med. J.* 21(3-4):249-258, 1975.

Gastric intramural vascular changes in stomach during or shortly after bleeding were determined under a microscope in 41 surgical specimens after visualizing the vessels with indian ink. A relation between the patient's circulatory disturbance due to hemorrhage and the features of the gastric vascular damage was sought. The degree of circulatory disturbance due to gastric bleeding was graded as mild (Group I), moderate (Group II), or serious (Group III) according to the response of the patient to a test transfusion given rapidly in a volume up to 1000 ml. The main pathological features observed in the bleeding groups were such changes as rupture of the large or capillary blood vessels at an ulcer crater; rupture, dilatation or tortuosity of the mucosal capillary vessels; and rupture or tortuosity of the submucosal vessels. The presence of the pathological changes was most marked in Group III (6 patients), and rupture of the

large blood vessels was only seen in this group. Two specimens in Group III had no arterial rupture but showed a high degree rupture of the mucosal and ulcer's capillary, which may explain their serious bleeding. The outstanding feature of Group II (14 patients) was a high incidence of marked rupture of the mucosal capillary, which should explain bleeding in this group. Mild bleeding of Group I (21 patients) may be explained by the fact that this group had no bleeding from an ulcer and that rupture of the mucosal capillary was not severe. It is concluded that the rate of gastric bleeding and the vascular status of bleeding lesions can be correlated to some extent.

7139 GASTROSCOPIC OBSERVATIONS RELATED TO BIOPTICAL HISTOLOGY IN HEALTHY MEDICAL STUDENTS. *(E.)* Myren, J.; Serck-Hanssen, A. (Ulleval Hosp., Oslo 1, Norway). *Scand. J. Gastroenterol.* 10(4):353-355, 1975.

Gastric mucosal samples from ten healthy volunteers were studied by gastroscopy with histology in directed biopsy specimens. Gastroscopy was performed after an overnight fast and an i.v. injection of 1 ml of pethidin with 0.3 mg of atropine. Degrees of mucosal alterations were categorized as: no alteration (0), slight changes (1), moderate (2), and pronounced reddening and mucus covering (3). A normal mucosal folding was recorded as 2, decreased folding was recorded as 1, and increased folding was recorded as 3. Directed biopsies (three to eight) were taken from the antral mucosa, and from the mucosa of the greater and lesser curvatures. Normal mucosal folding was found in all subjects. None had mucosal reddening or mucus covering of more than slight grades. Gastroscopy showed normal mucosa in four, probably normal in two, and superficial gastritis in four. Histology revealed a normal mucosa in the antrum of six subjects, normal lesser curvature mucosa in seven and normal at the greater curvature in eight. There was a good correlation between gastroscopic observations and bioptical histology on directed biopsies in six subjects.

7140 IS INTESTINAL METAPLASIA OF THE GASTRIC MUCOSA A PRE-MALIGNANT LESION? *(E.)* Reynolds, K. W.; Johnson, A. G.; Fox, B. (Charing Cross Hosp., London, England). *Clin. Oncol.* 1(2):101-109, 1975.

The histological and clinical evidence indicating that intestinal metaplasia of the gastric mucosa is premalignant is reviewed. Histologically, the normal surface columnar epithelium of the gastric mucosa is secretory in function whereas the intestinal surface is both absorptive and secretory. In intestinal metaplasia, there is a morphological and histochemical transformation to a small bowel type of epithelium. It appears that with intestinalization, the gastric mucosal surface epithelium exchanges a secretory for an absorptive function. Clinical evidence indicates that intestinal metaplasia frequently occurs in the same stomach with carcinoma, and that it often occurs closely adjacent to the carcinoma. Furthermore, there is some evidence that metaplasia precedes neoplastic transformation and that the incidence of subsequent carcinoma in patients with intestinal metaplasia is higher than the predicted incidence for the population as a whole. A fairly close connection between endoscopic appearances and histological evidence of intestinal metaplasia has recently been demonstrated; such studies have shown an association between intestinal metaplasia and x-ray negative dyspepsia, as well as between metaplasia and x-ray negative dyspepsia, as well as between metaplasia and gastric ulcer and carcinoma. Although the connection between intestinal metaplasia and carcinoma is not proven beyond doubt, there is sufficient evidence that the former is premalignant to outline a scheme of surgical management: patients showing intestinal metaplasia should be followed-up by regular endoscopy; benign gastric ulcers should in most cases be removed by Billroth I gastrectomy; and duodenal ulcer should be treated by procedures such as highly selective vagotomy rather than polya gastrectomy or gastro-jejunostomy, the former being less likely to produce a gastritis. Antrectomy-en-Roux may prove to be a beneficial prophylactic procedure in patients with severe dyspepsia, bilious vomiting, and well-established intestinal metaplasia.

7141 MICROSCOPICAL CANCER OF THE STOMACH — A STUDY ON HISTOGENESIS OF GASTRIC CARCINOMA. *(E.)* Nagayo, T. (Aichi Cancer Center Res. Inst., Nagoya 464, Japan). *Int. J. Cancer* 16(1):52-60, 1975.

To elucidate the histogenesis of gastric cancer preceded by "chronic gastritis," 67 foci (58 cases) of cancer less than 5 mm in diameter were examined histologically. The resected stomachs in all 58 cases were photographed and histological specimens from the main lesion and other parts of the stomach were embedded in paraffin and stained with hematoxylin, eosin, and PAS. Most of the minute cancerous foci were found in the mucosa of the antrum or angulus and were most frequent in the lesser curvature. In all but two cases, these minute foci occurred with peptic ulcer (42 cases) or gastric cancer (14 cases) and were found unexpectedly during the course of routine histological examinations. Minimal erosion was observed in 31 foci, tiny mucosal depressions were seen in ten foci, and no recognizable macroscopic changes were seen in 26 foci. Eighteen foci were located near the main lesion, while 40 were located far from it; seven foci were found in the mucosa adjacent to an ulcer scar. The histological changes in the minute foci were closely correlated with the grade of intestinal metaplasia: well- or moderately well-differentiated adenocarcinomas always occurred in combination with a high degree of intestinal metaplasia; poorly differentiated adenocarcinomas were associated with slight or no metaplasia. Regardless of histological type, the microscopic cancerous changes were always observed in the transitional zone between the foveolar epithelium and pyloric glands. The foci composed of differentiated adenocarcinoma cells were always seen on the deepest layer of the metaplastic mucosa or in the place where the metaplastic foveolar epithelia were situated, and the poorly differentiated adenocarcinomas were primarily found in the middle layer of the nonmeta-

plastic gastric mucosa. It is concluded that chronic gastritis is the most important and essential change for the development of gastric cancer. Foci in the flat mucosa can be used as a prototype for studying the histogenesis of gastric cancer from this condition.

7142 GASTRIC CANCER SCREENING IN OSAKA. *(E.)* Aikawa, K. (Center Adult Diseases, 1-3-3 Nakamichi, Higashinari-Ku, Osaka, Japan). *Prevent. Med.* 4(2):154-162, 1975.

An epidemiological, clinical and administrative study of gastric cancer, being carried out in cooperation with the Center for Adult Diseases in Osaka, Japan, is described. The mass-screening program for gastric cancer was originally conducted using mobile units equipped with photofluorographic apparatus in the community and several industrial and business enterprises in a mass-screening program at the Center was later introduced. Gastric cancer was detected in 0.33% of the 78,404 persons examined during the period June 1961-December 1970; approximately 1/3 of these persons had early-stage cancer. The program efficiency of the mobile-unit program was evaluated in a 3-yr study involving 50.5% of the persons aged 40 yr and over living in an agricultural district in the Osaka Prefecture. About 55% of all new cancer cases in this district were detected by mass screening, 77.8% of the gastric cancer cases between 40 and 60 yr of age being detected in this manner. The 5-yr survival rate was significantly higher among those who received mass examination than among those who did not. The program in this district has now been in operation for 10 yr, and the age-adjusted mortality rate from gastric cancer was slightly lower in the second 5-yr period than in the first 5-yr period. In addition, the initial beneficial effects of the mass examination program appeared to last for 2 to 3 yr. At the Center, examinees are screened by a televised X-ray system as well as by gastrocamera and cytologic examination in some cases. The results to date indicate that the Center is more efficient in detecting abnormalities than the mobile units, this being particularly true of early stage gastric cancer. The rates of all gastric diseases except gastric polyps were higher among males than females. It is recommended that a cooperative cancer prevention system be established to meet increasing demands for mass screening in order to decrease the number of cancer deaths.

7143 GASTRIC FUNCTION IN PRIMARY HYPERPARATHYROIDISM IN MAN. *(E.)* McGeown, M. G.; Connell, A. M. (Belfast City Hosp., Belfast, Northern Ireland). *Irish J. Med. Sci.* 144(6):217-226, 1975.

Gastric function was studied preoperatively in 24 men and 31 women with primary hyperparathyroidism. Six patients had hyperparathyroid bone disease, 44 had renal stones without bone disease, and five had hypercalcemia. All patients were closely questioned for dyspeptic symptoms, evaluated following a barium meal, and given a Kay's augmented histamine test for gastric acid secretion. Tests for antibodies to gastric parietal cells and thyroid were carried out in 20 patients, and serum gastrin in the fasting state was estimated before and after parathyroidectomy in 10 additional patients whose barium meals and pentagastrin tests were normal. Symptoms of dyspepsia were present in 41% of the males and 31% of the females, and active or healed duodenal ulcers were found in 29% of the males and 16% of the females. Six patients had hiatus hernia and one a diverticulum of the duodenum. None of the patients had a gastric ulcer. Kay's augmented histamine test revealed achlorhydria in 11% of the patients and hyperchlorhydria in another 11%, the remaining patients showing normal acid secretion. The acid secretion did not differ significantly from that in a control group of euparathyroid patients without duodenal ulcers. In the hyperparathyroid patients, there was no relation between the basal or posthistamine secretion of acid and the maximum serum calcium concentration. Gastric parietal cell and thyroid antibodies were not detected in any of the patients tested, including five with achlorhydria. Fasting serum gastrin levels were normal in seven and slightly raised in three patients before parathyroidectomy; following surgery, the levels were increased in three of the nine patients tested and unchanged in the others. It is concluded that there is an increased incidence of dyspepsia and duodenal ulcers among patients, particularly male patients, with primary hyperparathyroidism.

7144 IS CHRONIC GASTRITIS A REVERSIBLE PROCESS? FOLLOW-UP STUDY OF GASTRITIS BY STEP-WISE BIOPSY. *(Eng.)* Rosch, W.; Demling, L.; Elster, K. (Dept. Internal Medicine, Univ. Erlangen-Nurnberg, Erlangen, Germany). *Acta Hepatogastroenterol. (Stuttg).* 22(4):252-255, 1975.

Step-wise biopsies along the minor and greater curves of the gastric mucosa of 36 patients (13 female, 23 male, mean age 49 yr) were performed in 1971 and in 1974 to 1975 in order to gain a representative idea of gastritic changes in the stomach. A comparison of the histological changes revealed identical findings in 15, progression of superficial gastritis in nine, and regression of superficial gastritis in seven. Regression of chronic atrophic gastritis was observed in five patients. In one patient an essentially normal mucosa was found in all biopsy specimens, and in two other patients, parietal cells reappeared without any specific therapy.

7145 STIMULI FOR HEPTADECAPEPTIDE GASTRIN RELEASE: A COMPARISON OF ORAL AND INTRAVENOUS ARGININE-MONOCHLORIDE AND OXO IN NORMAL, VAGOTOMIZED AND ANTRECTOMIZED PATIENTS. *(E.)* Vinik, A. I.; Kalk, W. J.; Dent, D. M.; Barbezat, G.; Grant, B. J.; Bank, S. (Groote Schuur Hosp., Capetown, South Africa). *Gut* 15(11):97-100, 1975.

The effects of i.v. arginine (10 mg/kg/min for 30 min), p.o. arginine (30 g) and p.o. Oxo (4 cubes) on serum gastrin responses in man were compared in nine normal, six vagotomized, and three antrectomized patients. Basal gastrin concentrations were similar

in the control groups for p.o. and i.v. arginine and the Oxo meal, ranging from 26-77 pg/ml. This contrasts with the lower 26.4 ± 3.4 pg/ml in the truncal vagotomized patients and the undetectable levels in antrectomized subjects. I.v. arginine caused a sharp early rise in serum gastrin concentration from a basal of 48.3 ± 2.14 pg/ml to almost three times the basal concentration at 15 min in control subjects. With p.o. arginine there was no rise in serum gastrin concentration. P.o. Oxo feeding caused only a two-fold increase in gastrin above the basal concentration. I.v. arginine had no effect in antrectomized and vagotomized subjects. The reason for the absence of gastrin response to p.o. arginine is not apparent, but taken in conjunction with the marked response elicited by the i.v. route, this suggests that arginine is ineffective as a gastrin stimulant by local application to the antrum in man; it may require absorption, with high blood concentration, to act on the gastrin releasing mechanism.

7146 INHIBITORY EFFECT OF L-GLUTAMINE ON GASTRIC IRRITATION AND BACK DIFFUSION OF GASTRIC ACID IN RESPONSE TO ASPIRIN IN THE RAT. *(E.)* Okabe, S.; Honda, K.; Takeuchi, K.; Takagi, K. (Faculty Pharmaceutical Sciences, Univ. Tokyo 7-3-1 Hongo, Bunkyo, Tokyo, Japan). *Dig. Dis.* 20(7):626-631, 1975.

The effect of L-glutamine on aspirin-induced gastric lesions at different time intervals was examined. Prevention of back acid diffusion by L-glutamine was also studied in intact and vagotomized rats. Gastric lesions were induced in pylorus-ligated male Donryu rats with 100 mg/kg of aspirin. Aspirin induced gastric lesions at 1 hr after intubation, and lesion formation reached a maximum after 3 hr. L-Glutamine (750 mg/kg) produced a 90% reduction in aspirin-induced gastric lesions. There was a slight but significant increase in gastric secretion by combined aspirin and L-glutamine (319.4 mOsM/kg) at 1 and 3 hr. There was a marked inhibition of $H^+$ loss by L-glutamine and a corresponding increas in $Na^+$. Diffusion of $H^+$ in vagotomized rats into the gastric mucosa and release of $Na^+$ was not altered by aspirin. L-Glutamine alone or in combination with aspirin inhibited back diffusion of $H^+$ in vagotomized rats. It is suggested that the inhibition of L-glutamine of aspirin-induced gastric lesions is due to an initial, direct protective effect on the gastric mucosa, and to a subsequent prevention of back acid diffusion.

7147 STATISTICAL EVALUATION OF PREVENTIVE USE OF GLUTATHIONE AGAINST SIDE-EFFECTS OF SURGICAL ADJUVANT CHEMOTHERAPY IN GASTRIC CANCER PATIENTS. *(E.)* Itoh, I.; Nakazato, H.; Taguchi, T.; Onoda, T. (Natl. Cancer Cent. Hosp., Tokyo, Japan). *Jpn. J. Clin. Oncol.* 5(1):19-28, 1975.

The ability of glutathione (GSH) to prevent the side-effects manifested during surgical adjuvant mitomycin C chemotherapy was evaluated in 374 cases of gastrectomy for stomach cancer. Of the 374 cases, 174 (controls) were given mitomycin C on and after the day of surgery (total 0.8 mg/kg, i.v.) and twice weekly thereafter (0.08 mg/kg/day, i.v.). The remaining 173 patients were treated similarly, but in addition were given GSH (600 mg/kg/day) i.v. daily for 2 weeks from the day of surgery followed by 600 mg/day p.o. until the last day of mitomycin C administration. The control and GSH groups were similar in terms of 33 background factors, including sex, age, preoperative general condition, and surgical findings. Mitomycin C administration was suspended prior to completion of the total prescribed dose for reasons other than the side-effects in a comparable number of patients from both groups. Discontinuation of mitomycin C treatment due to side-effects was significantly reduced in the GSH group (10.4%) in comparison with the control group (20.3%). In addition, the incidence of abnormally low WBC values (<3000) after the start of mitomycin C treatment was significantly reduced in the GSH group compared with the control group. The two groups did not differ in terms of the incidence of decreased thrombocyte and RBC counts after mitomycin C treatment. The incidence of abnormal SGOT values and the manifestation of positive urine albumin were reduced in the GSH group compared with the control group, but the results are of questionable significance due to the limited number of cases tested. The results indicate that GSH administration is effective in preventing the side-effects and the possible drop in WBC count associated with adjuvant mitomycin C chemotherapy. It may also be of some value in preventing mitomycin C-induced hepatic and renal abnormalities.

7148 EFFECTS IN RATS OF SODIUM CHLORIDE ON EXPERIMENTAL GASTRIC CANCERS INDUCED BY N-METHYL-N'-NITRO-N-NITROSOGUANIDINE OR 4-NITROQUINOLINE-1-OXIDE. *(E.)* Tatematsu, M.; Takahashi, M.; Fukushima, S.; Hananouchi, M.; Chirai, T. (Nagoya City Univ., Medical Sch., 1 Kawasumi, Mizuho-cho, Mizuho-ku Nagoya 467, Japan). *J. Natl. Cancer Inst.* 55(1): 101-106, 1975.

The effects of NaCl (6 g/liter in the drinking water on 1 ml/week by intragastric tube) on gastric carcinomas induced by N-methyl-N'-nitro-N-nitrosoguanidine (MNNG, 50 mg/liter in the drinking water) and 4-nitroquinoline-1-oxide (NQO, 1 mg/week by intragastric tube) were studied in adult male Wistar rats. In some cases, the rats were fed a stock diet containing 10% NaCl. The MNNG and NQO treatments were continued for 20 weeks, and the tumor incidence was determined in all animals surviving more than 40 weeks. In the MNNG-treated rats, most of the tumors developed in the glandular stomach, whereas in the NQO-treated animals, almost all tumors developed in the forestomach. No tumors developed in untreated controls or in the animals given only NaCl in the drinking water and/or diet. The forestomach tumors were all of squamous cell origin; the incidence of such tumors in the animals given NQO plus NaCl in the diet and/or by intragastric tube was greater than in the rats given NQO alone. The incidence of adenocarcinomas in the glandular stomach was also higher in the groups given MNNG plus NaCl than in the animals given MNNG alone; poorly differentiated adenocarcinomas were detected only in the animals treated with MNNG plus NaCl. Some tumors were found in the large and small intestines, liver, pancreas, and omentum

in the MNNG-treated rats, and metastases to the lymph nodes or liver were seen in some of the carcinogen-treated rats. No malignant tumors were detected outside the gastrointestinal tract in any group. The data indicate that NaCl alone is not carcinogenic, but that it enhances the carcinogenic effects of MNNG and NQO in the rat stomach. NaCl appears to enhance the penetration of the carcinogens but probably is not a 'promoter'.

7149 EFFECT OF ZOLIMIDINE, A DERIVATIVE OF IMIDAZO (1,2-a) PYRIDINE, ON THE GASTRIC MUCOSA OF PATIENTS WITH GASTRIC DISORDERS. *(E.)* Celli, L.; Clementi, F.; Santagostino, C. (Maggiore Hosp., Milan, Italy). *Curr. Ther. Res.* 18(1):105-123, 1975.

The morphology of the gastric mucosa before and after treatment with zolimidine by endoscopic, histological and ultrastructural analysis of a single mucosal zone was studied. Biopsy specimens were taken from ten patients with various gastric abnormalities under medical treatment. Tissues were fixed in formaldehyde, and stained with PAS or uranyl acetate and lead citrate. Studies were made before and after p.o. administration of the drug (800 mg/day) for 4 wks. In four patients with advanced ulcer the drug produced a clear surfacing of the ulcer, with disappearance of the subjective symptoms. Histological examination showed satisfactory healing of the tissues. Electron microscopy revealed a completely normal cellular infrastructure. The presence of a greater number of mucous granules was noted in the apical zone as well as more frequent exocytosis. In three cases of inflammatory and erosive gastropathy, repair of the lesion was obtained, and in one other case there was a return to normality. An effect of the drug on the mucosal barrier was demonstrated in all cases. These results demonstrate that the drug does not produce intracellular lesions, has mucopoietic activity and acts positively on the gastric barrier in reproductive, reparative, defensive and functional processes.

7150 GASTRIC EMPTYING FOLLOWING VAGOTOMY AND ANTRECTOMY AND PROXIMAL GASTRIC VAGOTOMY. *(E.)* Kalbasi, H.; Hudson, F. R.; Herring, A.; Moss, S.; Glass, H. I.; Spencer, J. (Hammersmith Hosp., London, England). *Gut* 16(7):509-513, 1975.

The effects of posture, vagotomy and antrectomy, and proximal gastric vagotomy on the gastric emptying of a standard physiological solid meal (eggs, toast, butter, jam, milk) labeled with $^{129}Cs$ were studied in 19 patients who had undergone proximal gastric vagotomy and 16 patients who had undergone truncal vagotomy and antrectomy for duodenal ulcer. The studies were performed 1, 4, 6, and 12 months after surgery. On completion of the test meal, the subjects were placed in a supine or sitting position under the gamma camera and data collection was begun within 5 min of the end of the meal; the study was continued for 90 min. Gastric emptying was significantly slower in the vagotomy plus antrectomy group 1 month after surgery than in a healthy control group. The difference was reduced at 4 months, and gastric emptying in the surgery group was normal at 6 months. At no stage did the proximal gastric vagotomy patients differ significantly from the controls in this respect. Symptoms of epigastric fullness were significantly more frequent in the vagotomy plus antrectomy patients than in the proximal vagotomy patients. Gastric emptying was similar in the supine and sitting positions in all groups, but the vagotomy plus antrectomy patients cleared significantly less of the meal in both positions than did the controls; again, the proximal vagotomy patients did not differ significantly from the controls. It is concluded that any differences in gastric emptying patterns which can be attributed to the effect of posture are of small scale and are restricted to particular groups of patients, such as those with rapid emptying patterns. However, future studies should employ the sitting position as this is closer to normal conditions.

7151 THE ROLE OF ACID AND ISCHEMIA IN PRODUCTION OF STRESS ULCERS DURING CANINE HEMORRHAGIC SHOCK. *(E.)* Zinner, M. J.; Turtinen, L.; Gurll, N. J. (Walter Reed Army Medical Center, Washington, D.C. 20012). *Surgery* 77(6):807-816, 1975.

Twenty adult mongrel dogs with an internally drained Heidenhain pouch were divided into three groups (Group 1, ten animals bled to 45 mm Hg mean arterial pressure and exposed to acid through the pouch; Group 2, seven controls; Group 3, three animals bled to a 45 mm Hg mean arterial pressure without acid exposure). The groups were studied for variations in electrical potential difference (PD), aminopyrine clearance, and net $H_2O$, $Na^+$, $H^+$, $K^+$, and $Cl^-$ flux. PD was measured through a bridge from the femoral vein to the gastric lumen. Aminopyrine was infused as an i.v. dose of 20 mg/kg and maintained at 5 mg/kg/hr. Clearance was measured as an indicator of mucosal blood flow. Acid test solution (80 mM of HCl, 80 mM of NaCl, 1.5 g/l of polyethylene glycol) was instilled in the pouch, left for 30 min, then drained and replaced by a solution lacking the glycol. Total pouch flow decreased from 37 ml/min to 6 ml/min in group 1 while it remained stable (32 ml/min in controls and 24 ml/min after 5 hrs) in group 2. PD in group 1 decreased from 54 mV to 25 mV, while it remained stable at 57 mV in group 2. $Na^+$ and $H^+$ flux remained stable in both groups, while $Cl^-$ fell from a control of 56.8 µEq/30 min/100 cc to -11.7 µEq/30 min/100 cc in group 1. $K^+$ flux increased from 2.3 µEq/30 min/100 cc to 10.5 µEq/30 min/100 cc in group 1 and remained stable in group 2. Nine of ten pouches in group 1 showed superficial erosions by gross examination, while none in the other groups demonstrated lesions. It appears that $K^+$ flux may reflect loss of mucosal integrity, rather than $Na^+$ or $H^+$, and that acid is a necessary component in the pathogenesis of stress ulcer.

7152 STUDIES CONCERNING THE APPEARANCE OF THE LESION IN THE UPPER PORTION OF THE INDIRECT GASTRIC RADIOGRAPH OF MASS EXAMINATION. *(Jpn.)* Miura, T.; Hachiya, T.; Oishi, H.; Aburatani, R.; Takahashi, H.; Hamada, N.; Shibathuji, H.; Shunagawa, M.; Kondo, H.; Fukuyama, T. (Nara Medical Univ. Cancer Center, Japan). *J. Nara Med. Assoc.* 25(4,5):378-386, 1974.

7153 APPLICATION OF DIRECT pH MEASUREMENT IN THE STOMACH TO CLINICAL GASTROENTEROLOGY AND BALNEOLOGICAL RESEARCH. *(Ger.)* Skapik, V. M.; Cap, J.; Kyral, V.; Chvatalova, M. (Marianske Lazne Balneol. Research Inst., USSR). *Z. Physiother.* 26(6): 401-411, 1974.

7154 GASTROSCOPY AND STOMACH BIOPSY ON THE OPERATED STOMACH. *(Ger.)* Landers, P. J. (Altona General Hosp., Hamburg, Germany). *Med. Welt* 26(7):288-291, 1975.

7155 INVESTIGATIONS ON THE RELATION BETWEEN BILE REFLUX AND STOMACH DISEASE. *(Ger.)* Lechner, H. J. (Medizinischen Klinik II der Stadtischen Krankenanstalten Solingen, Germany). *Med. Welt* 26(2):72-74, 1975.

7156 RELATIONSHIP BETWEEN PERISTALSIS IN A STOMACH OPERATED UPON AND THE METHOD OF RESECTION, AS EVIDENCED FROM THE ELECTROGASTROGRAPHY FINDINGS. *(Rus.)* Goldin, V. A.; Mikhailidis, K. A. (Clin. Gen. Surg., Moscow Med. Inst. Stomatol., USSR). *Sov. Med.* (2):61-65, 1975.

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7202 "TRENCH ULCER" OF THE STOMACH. A STUDY OF 14 CASES. *(E.)* Kamada, T.; Fusamoto, H.; Masuzawa, M.; Hiramatsu, K.; Fukui, O. (Osaka Univ. Medical Sch., 3 Dojimahamadori Fukushima-ku, Osaka 553, Japan). *Am. J. Gastroenterol.* 63(6):486-489, 1975.

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7204 CANCER OF THE GASTRIC STUMP FOLLOWING OPERATIONS FOR BENIGN GASTRIC OR DUODENAL ULCERS. *(E.)* Gazzola, L. M.; Saegesser, F. (Montefiore Hosp., Univ. Pittsburgh, Pittsburgh, Pa.). *J. Surg. Oncol.* 7(4):293-298, 1975.

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7207 GASTRIC CANCER IN CHILE: A COOPERATIVE INTERHOSPITAL STUDY II: TREATMENT AND POSTOPERATIVE EVOLUTION. *(E.)* Csendes, A. (Hosp. Jose Joaquin Aguirre, Santiago, Chile). *Jpn. J. Clin. Oncol.* 5(1):47-52, 1975.

See also, 6744, 6980, 6982, 7004, 7009, 7013, 7035, 7043, 7064, 7065, 7069, 7075, 7092, 7097, 7101, 7109, 7124, 7217, 7235, 7243, 7246, 7247, 7248, 7275, 7276, 7277, 7292, 7298, 7314, 7321, 7340, 7396, 7407, 7613, 7772, 7773, 7782, 7848, 7855, 7860, 7864, 7865, 7867, 7872, 7876, 7884, 7910.

## STOMACH

### Peptic Ulcers

7208 ESOPHAGITIS AND DUODENAL ULCER. *(E.)* de Moraes-Filho, J. P. P.; Zaterka, S.; Pinotti, H. W.; Bettarello, A. (Sao Paulo Sch. Medicine, Sao Paulo, Brazil). *Digestion* 11(5-6):338-346, 1975.

The incidence of reflux esophagitis and the manometric characteristics of the lower esophageal sphincter in 35 male duodenal ulcer patients was investigated. All patients were submitted to radiological examination of the esophagus, esophagoscopy, histologic study, manometric study of the lower sphincter of esophagus, a study of the gastric secretion of HCl,

and statistical analysis. No radiological signs of mucosal fold alterations or strictures were observed in any patients. Esophagoscopy showed esophagitis in 12 of 36 patients. Inflammatory histological mucosal alterations were observed in 21 of the patients. The final diagnosis of esophagitis was established by endoscopy and/or histology in 22 patients. Basal and histalog-stimulated secretion was normal in 11 cases; basal was increased but histalog-stimulated secretion was normal in four cases; both basal and histalog-stimulated were increased in 13 cases; and basal was normal but histalog-stimulated secretions were increased in eight cases. There was no significant difference between the mean values of the resting gastroesophageal sphincter pressure and the length of the lower esophageal sphincter of the controls and the different groups (with and without esophagitis, presence or absence of duodenal narrowing, hypersecretion or normal secretion of HCL). The results show that alterations of esophageal mucosa are related neither to the duration of the ulcer disease nor to basal and histalog acid secretion. These findings suggest that esophageal mucosa is sensitive to regurgitated gastric secretion of its acid content. Also, the intensity of the inflammatory reaction was not increased in the patients with longer histories of duodenal ulcers, indicating that a certain balance occurred between aggression and esophageal resistance.

7209 THE STUDY OF INCIDENCE AND CLINICAL SYMPTOMS OF PEPTIC ULCER IN CERTAIN OCCUPATIONAL GROUPS. *(Bul.)* Stoianova, Z.; Stancheva, P.; Vlakhov, I. (Inst. Gastroenterology, Sofia, Bulgaria). *Vutr. Boles.* 13(3):70-77, 1974.

The incidence of peptic ulcer was studied in 2,979 female and 999 male workers in different occupational groups. The overall incidence of peptic ulcer was 3.8%; 3.1% in females and 5.8% in males. The incidence was highest in employees of the telephone company (14.2%); the incidence was 6.3% in steel workers, 6% in clothing factory workers, 2.7% in textile factory workers, and 2.3% in rubber factory workers. The age classes 20 to 30 yr, 31 to 40 yr, 41 to 50 yr and over 50 yr accounted for 20.8%, 43.6%, 27.5% and 8.1%, resp., of all cases. Peptic ulcer was localized in the duodenum in 95.3%, and in the stomach in 4.7% of all cases. Melena was established in 12.8%, hematemesis with melena in 2%, and stenosis of the pylorus in 0.7% of all cases. The incidence of neurasthenic syndrome was highest in the occupational groups with the highest incidence of peptic ulcer.

7210 GASTRIN DETERMINATIONS IN SYMPTOMATIC PATIENTS BEFORE AND AFTER STANDARD ULCER OPERATIONS. *(E.)* Stremple, J. F.; Elliott, D. W. (Univ. Pittsburgh Sch. Medicine, Pa.). *Arch. Surg.* 110(8):875-879, 1975.

Gastric acid secretion and serum gastrin levels in a wide variety of clinical conditions were compared in 157 subjects without ulcer and 157 patients with either primary or recurrent ulcer. The non-ulcer group included 125 patients with gastritis, reflux esophagitis, anephria, short gut syndrome, primary hyperparathyroidism and a gastrin-producing adenoma, and 32 normal subjects. Neither the mean fasting nor the mean postprandial serum gastrin levels in patient controls differed from these values in normal controls. There was no significant difference between basal or maximum acid output in normal controls (2.2 and 16.8 mEq/hr, resp.) compared to patients with gastric ulcer (2.1 and 19.5 mEq/hr, resp.). Patients with duodenal ulcers had markedly elevated mean basal and maximum acid outputs (5.2 and 34.1 mEq/hr, resp.) compared to normals and gastric ulcer patients. Fasting mean serum gastrin levels were 45 pg/ml in normal subjects and 43 pg/ml in duodenal ulcer patients compared to postprandial values of 75 and 77 pg/ml, resp. These differences were not significant. Patients after vagotomy and Billroth I or II operations had lower basal and maximum acid outputs after surgery than normals. Patients after vagotomy and Billroth II procedures had elevated fasting serum gastrin levels that decreased postprandially. Patients with recurrent ulcer after incomplete vagotomy and gastric resection had high gastric acid secretion and normal serum gastrin levels. Patients with recurrent ulcer after complete vagotomy and gastric resection with retained antrum had both high acid output and high fasting and postprandial serum gastrin levels. Basal acid outputs and serum gastrin levels were even more elevated in patients with the Zollinger-Ellison syndrome. These results demonstrate that basic gastric acid secretory studies in combination with serum gastrin determinations can aid in the diagnosis of the Zollinger-Ellison syndrome and recurrent ulcers.

7211 BLOOD FLOW DISTRIBUTION IN THE STOMACH OF CATS WITH GASTRIC ULCER. *(E.)* Skarstein, A.; Svanes, K. (Dep. General Surgery, Univ. Bergen, Norway). *Scand. J. Gastroenterol.* 10(4):339-345, 1975.

The blood flow distribution in the stomach of cats with a one-week gastric ulcer was investigated. Ulcer was induced in the anterior wall of the antrum by a subserous injection of 0.3 ml of a 20% acetic acid solution; controls were laparotomized only. Carbonized microspheres 15 ± 5μ in diameter and labeled with $^{169}Yb$ were used to measure blood flow in different regions and layers of the stomach. Approximately 2-3 million microspheres were injected into the left ventricle of the heart. Simultaneously a blood sample was drawn from the distal aorta at a flow of 1 ml/min. Standardized tissue samples were punched from the lesser curvature and the anterior and posterior walls of the antrum, corpus and fundus. In each sample the mucosa was separated from the muscularis. The radioactivity of blood and tissue samples was determined, and the blood flow was calculated for each tissue sample. Three groups of animals were examined: anaesthetized control animals; animals laparotomized one wk before examination, and animals with a one-week ulcer. In the control animals the blood flow was the same in corresponding regions of the anterior and posterior walls of the stomach. The flow was slightly lower in the antrum than the fundus. The flow was similar in the different regions of the muscularis. The muscularis flow was markedly lower than the mucosa

flow. In the laparotomized animals, the blood flow was increased in the muscularis of the corpus. In the ulcer animals, the mucosa flow was increased in the anterior wall of the antrum, and the muscularis flow was increased in the antrum and the anterior wall of the corpus. The results strongly suggest that gastrointestinal surgery with rough handling of the intestines is associated with marked circulatory changes in the abdominal organs.

7212 SERUM GROUP I PEPSINOGENS BY RADIOIMMUNOASSAY IN CONTROL SUBJECTS AND PATIENTS WITH PEPTIC ULCER. *(E.)* Samloff, M.; Liebman, W. M.; Panitch, N. M. (Harbor General Hosp., 1000 West Carson St., Torrance, Calif. 90509). *Gastroenterology* 69(1):83-90, 1975.

Serum group I pepsinogen levels were compared in 300 healthy controls, 389 patients without peptic ulcer, 136 patients with peptic ulcer, and seven with the Zollinger-Ellison syndrome. The mean serum group I pepsinogen levels in healthy and hospital controls were 110.6 and 100.0 ng/ml, resp., and in both groups were significantly higher in males than in females. Values for approximately 90% of the healthy controls ranged from 50 to 175 ng/ml, and this was determined as normal. The mean serum group I pepsinogen level was 410.6 ng/ml in 55 cases with serum urea nitrogen over 21 ng/100 ml. A high value was found in 39 (70.9%) of these patients. The mean serum group I pepsinogen level in 37 patients with chronic alcoholism was 73.4 ng/ml; in 46 cases with gastric ulcer, 116.6 ng/ml; in 18 with prepyloric ulcer, 179.4 ng/ml; in 13 with both duodenal and gastric ulcer, 177.2 ng/ml; and in 77 with duodenal ulcer, 221.3 ng/ml, median level 203.0 ng/ml. None of the patients in this last group had a low value, and 49 (63.6%) had levels over 175 ng/ml. These patients had significantly higher ($P < 0.001$) mean levels of serum group I pepsinogen than healthy male controls. Serum group I pepsinogen values ranged from 315 to 921 ng/ml (mean, 503.9 ng/ml) in patients with the Zollinger-Ellison syndrome. These data indicate that in comparison to healthy controls, patients with prepyloric ulcer, duodenal ulcer and the Zollinger-Ellison syndrome have significantly increased levels of serum group I pepsinogen, that patients with gastric ulcer have comparable values, and that those with chronic alcoholism have significantly decreased levels.

7213 STUDIES ON THE BINDING OF AMYLOPECTIN SULFATE WITH GASTRIC MUCIN. *(E.)* Kim, Y. S.; Bella, A.; Whitehead, J. S.; Isaacs, R.; Kemer, L. (Veterans Administration Hosp., 4150 Clement St., San Francisco, Calif. 94121). *Gastroenterology* 69(1):138-145, 1975.

Binding of canine gastric mucin to amylopectin sulfate gel was studied by chemical assay for reducing sugars and by column chromatography. Hydrated amylopectin sulfate gel (4 ml) was washed with 0.1 M citric acid-phosphate buffer (pH 7.0), and centrifuged at 48000 x *g* for 20 min. One ml of 0.8 mg/ml of mucin solution was added, the pH was adjusted in the range from 3 to 7 and the mixture placed in a 25 C bath for 2 hr, then centrifuged at 48000 x *g* for 20 min. The supernatant was decanted, filtered and assayed for reducing sugars as the determination of unbound mucin. Pasteur pipettes lined with glass wool were saturated with amylopectin sulfate and 0.02 M citrate-phosphate buffer (pH 3). The effluent was measured and assayed for neutral sugars and pH. Mucin (10-20 mg/ml) was incubated with aqueous amylopectin sulfate (10-50 mg/ml) for 30 min at 25 C. Aliquots of 25 µl were used for electrophoresis at various pH values. At pH 3 and pH 4, 65 to 85% of the mucin fraction was bound to the gel, while at pH 7, only 35 to 40% was bound. On column chromatography, one mucin fraction did not bind, while a second eluted at pH 4.5. When pepsin was applied to the column, it eluted upon application, except at pH 2. The mucin bands which remained at the origin on electrophoresis were bound by amylopectin sulfate, while those which migrated did not bind. It appears that there is little difference between the fractions which bound to amylopectin sulfate and those which failed to do so. It is suggested that pepsin-amylopectin sulfate interaction occurs only in states of excessive acid secretion.

7214 INHIBITION OF GASTRIC ACID SECRETION BY CIMETIDINE IN PATIENTS WITH DUODENAL ULCER. *(E.)* Henn, R. M.; Isenberg, J. I.; Maxwell, V.; Sturdevant, R. A. L. (Veterans Admin. Wadsworth Hosp. Center, Los Angeles, Calif.). *N. Engl. J. Med.* 293 (8):371-375, 1975.

The effect of cimetidine, a nonthiourea-containing $H_2$-receptor antagonist, on basal and meal-stimulated gastric acid secretion was studied in seven males with duodenal ulcer (age range, 36-63 yr). The effects of cimetidine and an optimally effective dose of an anticholinergic, propantheline bromide, on meal-stimulated gastric acid secretion were compared. Eight cimetidine tests (four basal and four meal-stimulated) were performed on separate days, in random order, and in double-blind fashion. Each dose of cimetidine markedly decreased gastric acid secretion as compared with either basal or acid secretion after placebo; mean gastric acid content of stomach aspirate 1 hr after placebo and cimetidine doses of 100, 200 and 300 mg were 0.9, 0.3, 0.4 and 0.1 mEq/hr, resp. Three hundred mg of cimetidine decreased mean basal acid secretion to almost zero for 5 hr. The increasing doses of cimetidine produced graded increases in mean blood concentrations. Cimetidine and optimal propentheline bromide each decreased meal-stimulated acid secretion; however, 300 mg of cimetidine produced greater mean secretory inhibition which lasted through three hr. Inhibition of gastric acid output was positively correlated with blood cimetidine concentrations. No effect on serum gastrin response to a peptone meal or evidence of clinical or biochemical abnormalities in serial acute tests were observed following cimetidine ingestion. Thus, cimetidine was a potent inhibitor of both basal and meal-stimulated gastric acid secretion, and its effects were dose-related. Because of its effectiveness in inhibiting gastric acid secretion, superior potency to anticholinergics, and the lack of acute side effects, cimetidine is suggested as a potential therapeutic agent for the treatment of patients with peptic ulcer disease provided no toxicity appears with chronic testing.

7215 A COMPARISON OF THE ACID NEUTRALIZING EFFECTS OF A COMBINATION OF ANTACID PLUS OXETHAZAINE (OXAINE M) COMPARED TO ANTACID ALONE (ALUDROX) IN DUODENAL ULCER PATIENTS. *(E.)* Novaes, C. C.; Richards, D. J.; Davis, G. R. (Santa Helena Hosp., Recife, Pernambuco, Brazil). *Curr. Ther. Res.* 18(1):124-131, 1975.

The effects of antacid and of antacid combined with oxethazaine on the development of gastric alkalinity and recovery of acidity were studied in 20 duodenal ulcer patients under maximal stimulation by a histamine analogue. Each patient received antacid/oxethazaine and antacid on successive days. The pH of the gastric milieu was continuously measured using a radiotelemetry capsule which was swallowed and positioned in the most dependent portion of the stomach. The histamine analogue was administered s.c. at a dose of 1.7 mg/kg; 60 min later, the antacid medications were administered by gastric tube. Anacidity was defined as a gastric pH of 3.5 or higher. Since the baseline pH values in the duodenal ulcer patients were quite low, the histamine analogue often produced little or no stimulation of gastric acidity. The mean peak pH produced by the oxethazaine/antacid mediation (5.29) was significantly greater than that produced by the antacid alone (4.5), and the mean duration of anacidity was longer after the oxethazaine combination (4.42 min) than after the antacid alone (2.74). The mean overall time period from medication administration to peak pH was nearly the same for both medications, as was the time required for return to pH 3.5 after attainment of the peak value. The oxethazaine/antacid effect could have been the result of an oxethazaine-induced increase in gastric pH, decrease in gastric acid secretion, and decrease in gastrin level.

7216 SERUM GASTRIN RESPONSE TO FOOD STIMULATION AND GASTRIC ACID SECRETION IN MALE PATIENTS WITH DUODENAL ULCER. *(E.)* Gedde-Dahl, D. (Rikshospitalet, Oslo, Norway). *Gut* 16(1):189-191, 1975.

The gastrin response to a test meal was recorded in nine male patients with duodenal ulcer, related to their gastric acid secretion before and after stimulation with pentagastrin, and compared with the findings in male controls. The serum gastrin concentrations were determined by radioimmunoassay, and gastric secretion of acid was determined before and after stimulation with 6 μg pentagastrin/kg given s.c. The patterns of gastrin response was biphasic, with an early maximum of the first peak in the patients *versus* a monophasic response with a maximum in the second hr in the controls. The mean value of basal acid outputs (BAO), both per subject and per kg, was significantly higher in the duodenal ulcer groups than in the controls; the mean values for maximal acid outputs (MAO) was not significantly different. There was a positive correlation between weight-adjusted BAO and MAO in controls, but not in the patients. The mean fasting serum gastrin concentration in the duodenal ulcer group, 109 ± 24.5 pg/ml, was significantly higher than in the control group, 42 ± 5.5 pg/ml. BAO values in the duodenal ulcer group correlated positively with the fasting serum gastrin concentration, total gastrin output, and the integrated gastrin response. The results indicate that the acid inhibitory feedback mechanism may be impaired in patients with duodenal ulcer disease.

7217 STIMULATION OF HUMAN PEPSIN OUTPUT BY TOPICAL HYDROCHLORIC ACID. *(E.)* Bynum, T. E.; Johnson, L. R. (Baylor Coll. Medicine, Houston, Tex.). *Dig. Dis.* 20(7):607-612, 1975.

The presence in man of an acid-sensitive reflex similar to that demonstrated in the dog was studied for its relation to ulcer disease. Pepsin output and concentration were measured from the stomach of healthy subjects during irrigation with phosphate buffer or 0.2 N HCl during twelve 15-min periods. There was a highly significant 4-fold increase in pepsin output and a three-fold increase in pepsin concentration after introduction of 0.2 N HCl. Secretion of pepsin increased immediately in the first period and remained at a high sustained level for the entire hour of perfusion. Pepsin output fell to control levels immediately following reintroduction of phosphate buffer. Pepsin outputs after 0.15 N HCl were lower than after the higher concentration, but this difference was not statistically significant. These results indicate that pepsin output increases significantly during acidification of the gastric mucosa in man, and may play a significant pathogenic role in ulcer production.

7218 RELIEF OF DUODENAL ULCER SYMPTOMS BY ORAL METIAMIDE. *(E.)* Pounder, R. E.; Williams, J. G.; Milton-Thompson, G. J.; Misiewicz, J. J. (Central Middlesex Hosp., London, NW10 7NS, England). *Br. Med. J.* 2(5966):307-309, 1975.

A double-blind clinical trial of oral metiamide and a placebo was performed on 30 duodenal ulcer patients to determine its effect on symptoms and antacid consumption in this disease. Treatment consisted of 200-mg metiamide tablets, 3 times/day after meals and 400 mg at night (15 patients) or the same amount of lactose-placebo (15). All subjects were followed at least 5 weeks, and 23 were treated for 8 weeks. Metiamide treatment produced a significant reduction of both day and night pain, and patients on placebo experienced more severe pain than those receiving metiamide. Patients on metiamide consumed significantly less antacid during weeks 2, 3 and 5 than controls. There were no adverse effects reported by any patient. Mild side effects (sedation, headache and dizziness) were reported by ten patients on metiamide and five controls, but these effects were not severe. It is suggested that treatment with an $H_2$-receptor antagonist produces an early remission of duodenal ulcer.

7219 ASPECTS OF THE EFFECT OF METIAMIDE ON PENTAGASTRIN-STIMULATED AND BASAL GASTRIC SECRETION OF ACID AND PEPSIN IN MAN. *(E.)* Thjodleifsson, B.; Wormsley, K. G. (Dept. Therapeutics, Univ. Dundee, Dundee, Scotland). *Gut* 16(7):501-508, 1975.

The pharmacological effects of metiamide on gastric acid and pepsin secretory inhibition were studied in 13 patients with duodenal (DU) and three with gastric ulcer (GU) to provide a basis for metiamide dose requirements in peptic ulcer treatment. The effect of metiamide on the response to a range of pentagastrin doses (0.05, 0.2, 1.0, and 4.0 µg/kg/hr for 60 min) in three normal subjects was determined, as was the interaction of metiamide and atropine on prolonged basal secretion. Pentagastrin infusion followed one of two dose schedules: i.v. bolus of 75 mg (Schedule I) or 20 mg (Schedule II), followed by continuous infusion of 30 mg during 60 min. Metiamide was injected, i.v., 10 min before the start and during the course of pentagastrin infusion. Gastric secretion of acid and pepsin was inhibited more in patients with GU than DU and gastric acid secretory inhibition was significantly greater than pepsin inhibition for all concentrations of metiamide. The mean calculated maximal response to pentagastrin was progressively depressed from 16.2 (control value) to 8.9 mM/30 min (schedule II) and further reduced to 6.1 mM/30 min (schedule I). The $ED_{50}$ of pentagastrin increased from 0.15 to 0.32 µg/kg/hr (II) and to 0.90 µg/kg/hr (I). Thus, metiamide inhibited both the maximal secretory response attainable with pentagastrin and decreased the sensitivity to pentagastrin. Atropine augmented and prolonged the action of metiamide. The powerful inhibitory action of metiamide on gastric secretion may have therapeutic value in treatment of diseases in which acid and pepsin secretion play an etiological role. However, the degree of secretory inhibition necessary to permit healing of mucosal lesions remains unknown.

7220 GASTRIC SECRETORY INHIBITION BY TWO 16-METHYLATED ANALOGS OF PROSTAGLANDIN $E_2$ GIVEN INTRAGASTRICALLY TO PATIENTS WITH DUODENAL ULCER DISEASE. *(E.)* Nylander, B.; Andersson, S. (Dep. Internal Medicine, Karolinska Hosp., Stockholm, Sweden). *Gut* 16(1):217-220, 1975.

The effects of two methylated analogs of prostaglandin $E_2$ ($PGE_2$), 16,16-dimethyl $PGE_2$ and its methyl ester, on gastric acid and pepsin secretion were studied in five ulcer patients. The gastric residuum was removed twice and radiovitamin $B_{12}$ was used as an indicator for the recovery of gastric juice. Gastric juice was collected continuously in 15-min samples. The mean control secretory rate of the five ulcer patients was 45 mEq/hr compared with 25 mEq/hr for controls. With 80 µg of 16,16-diMe $PGE_2$ the median pH of residuum I was 1.6 and that of residuum II, 5.9, indicating inhibition of basal gastric secretion. Concentrations of 80 and 140 µg of both compounds gave a dose-dependent decrease in acid output. It was necessary to give 140 µg of each analog to reach about the median effective dose. The mean values of pepsin output and pepsin concentration were decreased following administration of $PGE_2$, but the individual results varied. The results show that these two prostaglandin analogs inhibit gastric acid secretion in duodenal ulcer patients in a dose-dependent fashion and that the inhibition is mainly due to a reduction of volume, contributing to about 60% of the overall reduction of acid output.

7221 EFFECT OF SEROTONIN AND ENDOTOXIN ON ACUTE GASTRIC STRESS ULCERATION IN CONVENTIONAL AND GERM-FREE RATS. *(E.)* Batson, R. C.; Greenberg, P. H.; Nance, F. C. (Louisiana State Univ. Sch. Medicine, New Orleans, La.). *Surg. Forum* 24:426-428, 1973.

The effects of endotoxin and 5-hydroxytryptamine on conventional and germ-free mice subjected to restraint stress were studied. After fasting, 80 conventional and 40 germ-free mice were randomly divided into four groups, receiving i.p. injections of: 5-hydroxytryptamine (10 mg/kg); endotoxin (4 mg/kg); endotoxin plus 5-hydroxytryptamine, or saline. Animals were sacrificed 24 hr after being restrained by stapling between two pieces of screen wire. Restrained, germ-free mice had significantly fewer ulcers than conventional mice. Endotoxin alone had no effect on ulceration in either strain. Serotonin resulted in an increase in both the incidence and severity of ulcerations in both strains. Endotoxin and serotonin in combination induced a greater number of ulcers than serotonin alone. Neither humoral factor increased the number of ulcers in germ-free mice to the level observed in conventional controls. It is concluded that the germ-free state gives significant protection from restraint-induced ulceration.

7222 GASTRIC ACID AND PEPSIN SECRETION IN PATIENTS UNDERGOING INTERMITTENT HEMODIALYSIS. *(Ger.)* Pointner, H.; Flegel, U.; Schmidt, P.; Zazgornik, J.; Kopsa, H. (Med. Clin. I, Univ. Vienna, Austria). *Wein Klin. Wochenschr.* 86(22):693-696, 1974.

To evaluate the high incidence of gastrointestinal disturbances in uremia, gastric acid secretion and pepsin secretion were measured in 15 uremic patients undergoing biweekly hemodialysis. Eight of the patients had radiologically confirmed peptic ulcers and two had duodenal irritation without overt ulceration. One day before dialysis, fasting gastric juice was obtained in three 20 min periods (basal) and secretion was stimulated by pentagastrin (6 µg/kg body weight, s.c.). Gastric juice was obtained in six 15 min periods and the peak output was calculated from the two highest 15 min periods. The volume of the juice was measured. HCl concentration was measured by titration; pepsin activity was determined by a slight modification of the Anson and Mirsky method and expressed in mg of tyrosine. Mean basal acid output for all 15 patients was 3.9 mEq/hr; peak acid output was 25.3 mEq/hr; basal pepsin output was 20.2 mg tyrosine/hr; peak pepsin output was 71.4 mg tyrosine/hr. Gastric acid values from 30 normal individuals and pepsin values from five normal individuals did not differ from the values in the uremic patients. It is concluded that a multifactorial etiology must be assumed for ulceration in the cases studied. There was great variation of values between all patients but no correlation of acid or pepsin values to gastrointestinal disturbances. Mean blood urea nitrogen was 91.1 mg %, mean serum creatinine was 13.5 mg %, mean serum Ca was 9.2 mg % in the uremic patients. It is concluded that in uremic patients neither gastric acid secretion nor pepsin secretion is responsible for the high inci-

dence of peptic ulceration and other gastrointestinal distrubances.

7223 BONE MINERAL AFTER PARTIAL GASTRECTOMY II. *(E.)* Aukee, S.; Alhava, E. M.; Karjalainen, P. (Univ. Central Hosp., Kuopio, 70210 Kuopio 21, Finland). *Gut* 16(1):165-169, 1975.

Bone mineral measurements by the Americium-241 gamma ray attenuation method were performed on the cancellous bone of the left distal radius of three groups of ulcer patients (30 preoperative patients in Group I; 70 patients 3.3-8.5 yr post-1/3 gastrectomy and Billroth I reconstruction with selective vagotomy in 36 comprising Group II; 60 patients 15-18 yr post-2/3 gastrectomy and Billroth II reconstruction forming Group III) to study the mineral density of bone postoperatively. Group I did not differ significantly from controls (0.302 g/cc *versus* 0.301 in controls), nor did males in Group II (0.281 g/cc *versus* 0.289 in controls). Females in Group II showed significant decreases in mineral density (0.232 g/cc *versus* 0.260 in controls), as did all patients in group III (0.255 *versus* 0.289 in males and 0.230 *versus* 0.254 in females). When corrected for known diseases affecting bone metabolism, the decreased density in group III males was 9.3% and 9.4% in females. The mineral density of bone was decreased after ulcer surgery by approximately 10%, but this decrease did not appear to endanger the patients' health or well-being.

7224 DECREASE IN GASTRIC SECRETION DURING THE FIRST THREE MONTHS AFTER PROXIMAL GASTRIC VAGOTOMY IN DUODENAL ULCER PATIENTS. *(E.)* Roland, M.; Berstad, A.; Liavag, I. (Aker Univ. Hosp., Oslo, Norway). *Scand. J. Gastroenterol.* 10(4):363-367, 1975.

Gastric secretion was stimulated by i.v. infusion of pentagastrin (15 µg/kg/hr) before and 10 and 90 days after proximal gastric vagotomy in 16 duodenal ulcer patients. Postoperatively, pentagastrin (15 µg/kg/hr) was also given in combination with carbacholine (2 µg/kg/hr). Mean acid output in response to pentagastrin alone was reduced by 48% and 64% at 10 and 90 days, resp., after vagotomy. Mean pentagastrin stimulated acid output and volume of gastric juice was significantly higher at 10 days than at 90 days after the operation. Mean pepsin output decreased also, but the decrease was not statistically significant. There was no significant effect of carbacholine on pentagastrin-stimulated acid output either at 10 or 90 days. Carbacholine increased pentagastrin stimulated volume of gastric juice significantly at 19 but not 90 days postoperatively. The effect of carbacholine on pentagastrin-stimulated pepsin output was significant both 10 and 90 days after the vagotomy. Pepsin output in response to pentagastrin plus carbacholine 10 days after the operation was not significantly different from preoperative values. At 10 days postoperatively the increase in pentagastrin stimulated volume of gastric juice by carbacholine was significantly greater than at 90 days. The corresponding differences of acid and pepsin outputs were not significant. It is concluded that the preoperative secretion of acid cannot be restored by a maximal dose of pentagastrin or by pentagastrin in combination with carbacholine either 10 or 90 days after proximal gastric vagotomy. The results show a significant decrease in maximal acid output from 10-90 days after vagotomy.

7225 LONG TERM EFFECT OF HIGHLY SELECTIVE VAGOTOMY ON BASAL AND MAXIMAL ACID OUTPUT IN MAN. *(E.)* Greenall, M. J.; Lyndon, P. J.; Goligher, J. C.; Jonston, D. (General Infirmary, Leeds, England). *Gastroenterology* 68(6):1421-1425, 1975.

Basal acid output (BAO) and maximal acid output (MAO) were measured five yr after highly selective vagotomy (HSV) in 21 patients who had previously undergone serial testing of BAO and MAO for up to two yr after HSV. Gastric secretion was aspirated by continuous suction for a basal period of one hr and for one hr after the i.m. injection of 6 µg/kg of pentagastrin before operation and 10 µg/kg after operation. Stimulated acid output was expressed both as peak acid output to pentagastrin ($PAO^{Pg}$) which was peak 30-min acid output multiplied by two, and as total hour output, the acid output in the hour after the pentagastrin injection. BAO was the total amount of acid secreted during the basal hour. BAO decreased from a mean of 1.7 mEq/hr at one yr after HSV to 1.4 mEq/hr at five yr after HSV (not significant). The mean reduction in BAO at five yr, compared with the preoperative BAO of 8.4 mEq/hr, was 79%. The mean peak acid response to $PAO^{Pg}$, compared with the preoperative $PAO^{Pg}$ of 43 mEq/hr, was 51% at one year and 48% at five yr. Inasmuch as acid outputs seem unlikely to increase further after five yr, it is concluded that HSV produces a permanent reduction of about 80% in basal acid output and 50% in maximal acid output.

7226 A HISTOLOGICAL STUDY OF GASTRIC MUCOSA BEFORE AND AFTER PROXIMAL GASTRIC VAGOTOMY IN DUODENAL ULCER PATIENTS. *(E.)* Roland, M.; Berstad, A.; Liavag, I. (Aker Univ. Hosp., Oslo, Norway). *Gut* 16(1):181-186, 1975.

Suction biopsies were taken from the body of the stomach in 29 duodenal ulcer patients before and after proximal gastric vagotomy (PGV) in order to study the degree of gastritis, the gastric mucosal thickness and the number of parietal cells/unit area. All patients had a negative insulin test three month after the operation. A pentagastrin test was performed within two weeks before and 3 and 12 months after PGV. Three months after PGV, basal and pentagastrin stimulated acid secretion were reduced by 82 and 64% of preoperative values, resp. Twelve months after the operation the corresponding figures were 63 and 56%. There was a similar acid reduction in patients with and without gastritis. The number of patients with atrophic gastritis increased from three before the operation to 11 three months after PGV. There was no further increase from three to 12 months postoperatively. The average thickness of gastric mucosa and the mean number of parietal cells/unit area before PGV did not show any significant change three months and one yr after the operation. There was a significant correlation between the number of

parietal cells/unit area and maximal acid output before but not after PGV. Acid output/parietal cell was higher before PGV, suggesting that the decrease in gastric secretion after PGV cannot be attributed to the development of gastritis or reduction of parietal cell number.

7227 THE EFFECT OF ATROPINE AND VAGOTOMY ON THE SECRETION OF GASTRIC INTRINSIC FACTOR (IF) IN MAN. *(E.)* Vatn, M. H.; Semb, L. S.; Schrumpf, E. (Ulleval Univ. Hosp., Oslo 1, Norway). *Scand. J. Gastroenterol.* 10:59-64, 1975.

Concentrations of gastric intrinsic factor (IF), acid and pepsin in gastric secretions of eight duodenal ulcer patients treated with atropine (1 mg, i.v.) and seven patients successfully treated by proximal gastric vagotomy were compared during basal secretion and after stimulation by s.c. pentagastrin (6 mg/kg). Atropine was administered alone or coincidentally with pentagastrin. IF concentration was estimated by the hemoglobin-coated charcoal method. Atropine reduced the pentagastrin-stimulated increase in volume of gastric juice (208 ml, no atropine; 125 ml, with atropine), acid output (no atropine, 32.2 mEq; with atropine, 20.2 mEq), pepsin output (no atropine, 90.3 mg; with atropine, 22.8 mg), and IF output (10255 U *versus* 5364 with atropine), while concentrations of each did not differ significantly with atropine (acid, 119 mEq/l; pepsin, 453 mg/l; IF, 44 μ/l) or without atropine (acid, 119 mEq/l; pepsin, 538 mg/l; IF, 45 μ/l). Atropine reduced the volume of gastric juice (141 ml, basal, *versus* 52 ml, basal with atropine) and the acid concentration (70 mEq/l *versus* 52 mEq/l) and pepsin concentration (701 mg/l *versus* 547 mg/l) in gastric juice, while not altering the IF concentration in gastric juice (56 *versus* 49 μ/ml). Vagotomy reduced the concentration of acid (52 *versus* 29 mEq/l), while not altering the concentration of IF (42 *versus* 36 μ/ml) in gastric juice. The secretion of IF, acid and pepsin stimulated by pentagastrin was decreased by atropine, secondary to a reduction in the volume of gastric juice. Basal secretion of IF and IF concentration in gastric juice were unchanged by "medical" or surgical vagotomy.

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7288 THERAPY OF PEPTIC ULCER. *(E.)* Isenberg, J. I. (VA Admin. Hosp. Center, Wilshire and Sawtelle Blvd., Los Angeles, Calif. 90073). *JAMA* 233(6):540-542, 1975.

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7291 PENTAGASTRIN IN THE CLINICAL STUDY OF GASTRIC SECRETORY ACTIVITY. *(Rus.)* Boger, M. M.; Bersimbaev, R. I. (Inst. Cytol. Genet., Siberian Branch Acad. Sci. USSR, Novosibirsk, USSR). *Sov. Med.* (2):49-53, 1975.

7292 CONTENT OF CATECHOLAMINES, ACETYLCHOLINE AND CHOLINESTERASE ACTIVITY OF THE GASTRIC TISSUES IN SOME COMPLICATIONS OF ULCER DISEASE. *(Rus.)* Mellin, V. M.; Drozdovskaya, G. M. (Dept. Hosp. Surg., Kiev Med. Inst., USSR). *Vrach. Delo* (3):59-63, 1975.

See also, 6789, 7047, 7064, 7092, 7116, 7136, 7141, 7145, 7151, 7158, 7160, 7161, 7167, 7172, 7191, 7193, 7204, 7321, 7866, 7884, 7898.

## SMALL INTESTINE

7293 ACUTE DUODENITIS AND DUODENAL ULCERATION AFTER BURNS. CLINICAL AND PATHOLOGICAL CHARACTERISTICS. *(E.)* Czaja, A. J.; McAlhany, J. C.; Pruitt, Jr., B. A. (Brooke Army Med. Cent., Fort Sam Houston, Tex.). *JAMA* 232(6):621-624, 1975.

The clinical and pathological characteristics of Curling ulcer were defined by early and serial endoscopic examinations of the duodenum in 37 burned patients. Only two of these were women; the subjects ranged in age from 16 to 74 yr, with burn sizes ranging from 23% to 96% of the total body surface; mortality was 75.6%. Of 58 endoscopic procedures performed, there were no complications; 24 patients were studied within 72 hr after the burn and 13, 4-30 days later. Duodenal disease was present in 27 patients and occurred only in those with burns involving more than 38% of the total body surface. Erosive duodenitis was seen to occur in some patients within 12 hr after injury and was usually associated with acute gastric disease. Isolated duodenitis occurred only in patients with pancreatitis. Contrast roentgenograms did not reliably show the superficial mucosal disease. Duodenal ulcerations were present in 12 patients and developed on a background of diffuse superficial mucosal injury. Other complications in the patients' postburn course influenced disease progression. Hemorrhage occurred in six patients with duodenal disease, usually originating from a posterior duodenal ulcer. Uncomplicated ulcers invariably healed within 5 weeks after diagnosis. It is suggested that the goals of future investigations should be to define and control the factors that influence the progression or resolution of early superficial injury.

7294 MESENTERIC CYSTS: A CAUSE OF SMALL BOWEL OBSTRUCTION IN CHILDREN. *(E.)* Christensen, J. A.; Fuller, J. W.; Hallock, J. A.; Sherman, R. T. (Coll. Med., Univ. South Florida, Tampa). *Am. Surg.* 41(6):352-354, 1975.

A case of complete mechanical small bowel obstruction secondary to a mesenteric cyst in a 30-month-old girl is reported. The patient presented with a 4-day history of constipation, abdominal pain, and vomiting. Her abdomen was moderately distended and X-rays showed multiple air fluid levels and loops of distended small bowel. The child's WBC was 11,000 $mm^3$ with 73% polymorphonuclear cells and 3% bands. Her hemoglobin was 12 g% and her hematocrit was 36 mm. Laparotomy revealed marked dilation of the proximal small bowel and volvulus of the ileum around a cyst in the pelvis. A multiloculated mesenteric cyst, containing chylous fluid and involving mesentery of the ileum, was identified. Attempts to enucleate the cyst were unsuccessful and accordingly the small bowel and mesentery involved by the cyst were resected. The patient was discharged on the 7th postoperative day. Since 1964, 13 patients under 10 yr with mesenteric cysts have been reported in the English literature. Ten patients presented with an abdominal mass or distention. Chronic abdominal pain was present in 3 and acute pain in 5. X-rays including contrast studies were helpful in 5 cases. Bowel obstruction was noted in 4 cases. The rectosigmoid mesentery is difficult to resect and if enucleation cannot be done, internal drainage into the free peritoneal cavity is the procedure of choice.

7295 GASTRIC SECRETION AND SERUM GASTRIN IN HUMAN SMALL BOWEL BYPASS. *(Eng.)* Coyle, J. J.; Varco, R. L.; Buchwald, H. (Dept. Surgery, Univ. Minnesota, Minneapolis, Minn. 55455). *Arch. Surg.* 110(8):1036-1038, 1975.

The effect of massive small bowel bypass on basal and peak stimulated acid output and on the fasting serum gastrin level in man was studied. Jejunoileal bypass for massive obesity was performed on 37 patients. Gastric secretory studies were performed preoperatively and about 1 yr postoperatively. These patients underwent exclusion of the small bowel from 40 cm distal to the ligament of Treitz to 4 cm proximal to the ileocecal valve. A separate group of 26 patients who had undergone the same operation for obesity 2 yr prior to this time had fasting serum samples collected for measurement of gastrin levels. In the group of 37 patients, the average decrease in body weight was 43.4 kg during this first postoperative yr. The basal acid output stood at 1.95 mEq/hr preoperatively and 2.45 mEq/hr postoperatively. Peak stimulated acid output stood preoperatively at 14.80 mEq/30 min and 16.65 mEq/30 min postoperatively. Of the 37 patients, 24 showed increases in peak stimulated acid output (greater than 2 mEq/30 min in 16 patients). Clinically, 36 of these patients were asymptomatic with respect to possible gastric-related complaints. This study demonstrates no change in fasting serum gastrin levels of patients with massive intestinal bypass. It is suggested that the bypassed segment of the intestine may protect patients against fasting hypergastrinemia. However, the hormonal response to meals must be investigated in humans with small bowel bypass. The small, but statistically significant, increase in peak stimulated acid output was noted, but no clinical significance could be attached to it.

7296 LONG TERM CHANGES IN TOTAL BODY WATER, TOTAL EXCHANGEABLE SODIUM AND TOTAL BODY POTASSIUM BEFORE AND AFTER ILEOSTOMY. *(Eng.)* Hill, G. L.; Goligher, J. C.; Smith, A. H.; Mair, W. S. J. (General Infirmary, Leeds, England). *Br. J. Surg.* 62(7):524-527, 1975.

Total body water, total body potassium and total exchangeable sodium were measured in ten patients (6 men and 4 women, aged 26-63 yr) with inflammatory bowel disease. The measurements were made before and 6 mo after a permanent ileostomy was established. All patients underwent elective surgery, but all were malnourished when the first measurement was made before surgery. Six mo after the operation, all patients were in good health and their ileostomies were functioning normally. As a group they had gained 6.8 kg in body weight and 372 mEq in total body potassium over this period of time. In calculating the normal total body water before surgery, a deficit of 12.4% for the group was found. This deficit was still present in 11.1% 6 mo after operation. The concentration of exchangeable sodium in the body water fell from an abnormally high level before surgery to within the normal range 6 mo later. From these data it is obvious that deficits in total body water occurring before surgery are not repaired in the 6 mo after the establishment of a well-functioning ileostomy. A reduction of total exchangeable sodium was still present in patients with an ileostomy who were otherwise well. It is suggested that patients with intractable inflammatory bowel disease achieve good nutrition and normal body composition before this type of surgery is performed.

7297 QUALITY OF LIFE: THE CONTINENT ILEOSTOMY. *(E.)* King, S. A. (Stamford Hosp., Stamford, Conn.). *Ann. Surg.* 182(1):29-32, 1975.

Continent ileostomies (internal ileal reservoir or Kock Pouch) were constructed in 10 patients (five men and five women, aged 19-49 yr) suffering from ulcerative colitis (six), colitis (one), toxic megacolon (two), and mucosal disease (one). Of these 10 patients, nine were converted from a standard ileostomy with an external appliance to the continent ileostomy for various reasons. Of the nine, eight were converted successfully. Two patients suffered subsequent loss of continence due to reduction or intussusception of the nipple valve. In one of these two the adequacy of the pouch size seems to have a bearing on maintaining a satisfactory level of continence. The second patient is very much inconvenienced by varying levels of continence which are in part due to slow development of pouch size. Of three Type A reservoirs used, two have a satisfactory level of continence, albeit without full continence of flatus. The total failure is due to adhesions. Of seven Type C reservoirs, five are fully continent and have been so since surgery. The other two Type C patients became incontinent four months following surgery. A modification of the formation of the nipple by offsetting the mesentery to allow more complete suture placement may help in Type C reservoir patients. A dramatic improvement in life style was attested to by seven of the 10 patients, thus

illustrating the high level of patient satisfaction with a continent ileostomy. The most common postoperative complication in this series was small bowel obstruction, occurring in three of the 10 patients. Due to episodes of obstruction related to peanuts, sesame seeds, and kernel corn, it is recommended that these patients irrigate their pouches weekly with tap water until clear. Two pouch suture line leaks occurred in these 10 patients, one of the major operative risk elements with this procedure. With experience, the internal reservoir procedure is probably as safe as most other major operative procedures. The elimination of the need for an external appliance, thus allowing a more normal life style, may encourage earlier operative intervention in patients with ulcerative colitis with a concomitant reduction in morbidity and mortality.

7298 CHANGES IN CANINE GASTRIC ACID OUTPUT AND SERUM GASTRIN LEVELS FOLLOWING MASSIVE SMALL INTESTINAL RESECTION. *(E.)* Wickbom, G.; Landor, J. H.; Bushkin, F. L.; McGuigan, J. E. (Univ. Florida Coll. Medicine, Gainesville 32610). *Gastroenterology* 69(2):448-452, 1975.

Gastric acid output and serum gastrin concentration, both basal and in response to feeding, were compared before and after massive resection of the small intestine. Four mongrel dogs were given Heidenhain pouches and 24 hr secretions were collected from them for a 4-wk period. Acid output was measured by titration. Dogs were fed once daily. Each dog had four feeding tests. After a 36 hr fast, pouch secretions were collected for 60 min and a venous blood sample was taken. Dogs were then fed horsemeat (420 g), and pouch secretions were collected for 6 hr. Blood samples were taken 1, 2, 3, 4 and 6 hr after feeding. The intestine was then resected from 10 in distal to the ligament of Treitz to 10 in proximal to the ileocecal junction. The same daily meal was reinstituted and secretions were collected every 24 hr. Each dog had the four feeding tests repeated. Mean acid output was 9.12 mEq prior to resection and 27.6 mEq after, a 176% increase. At 2 hr after the test meal, gastrin serum concentration (154 pg/ml) was significantly greater after resection than that prior to resection (86 pg/ml). Serum concentrations at 3, 4, 5 and 6 hr after resection significantly exceeded those prior to resection. For 6 hr after feeding there was a high correlation between increases in secretion and in serum gastrin. Integrated serum gastrin response was 2.95 ng/hr/mg prior to resection and 6.74 ng/hr/mg after resection, a 128% increase. It is concluded that gastrin may be responsible for increased acid levels after intestinal resection.

7299 IN VIVO EFFECT OF BILE SALTS AND CHOLESTYRAMINE ON INTESTINAL ANAEROBIC BACTERIA. *(E.)* Williams, R. C.; Showalter, R.; Kern, F., Jr. (Univ Colorado, Sch. Medicine, Denver, Colo. 80220). *Gastroenterology* 69(2):483-491, 1975.

The effect of bile salts on human intestinal anaerobic bacteria *in vivo* was studied. Five normal male subjects (21-26 yr of age) were intubated, serially, into the small bowel before and after administration of bile salts and/or cholestyramine. In two subjects after bile salt administration and in one after cholestyramine, all organisms subcultured were aerobic. Generally, bile salt feeding led to a decline in the number of anaerobic organisms in all five subjects. Ileal anaerobes also decreased after cholestyramine, but the effect was not confined to a certain genome; rather, whichever genome was present was affected. Ileal bile salt concentrations did not correlate with the number of anaerobes. But after cholestyramine administration, there was an increase in the proportion of cholate and decrease in chenodeoxycholate and deoxycholate. The proportion of unconjugated bile salts was low and was unchanged by bile salt or cholestyramine treatment. In *in vitro* studies, only the growth of *Gaffkya anaerobia* was inhibited by cholestyramine. These results are unexplained, but do agree with previous findings.

7300 MOLECULAR BIOLOGY IN OLD AGE: 5. ENZYME ACTIVITY OF THE SMALL INTESTINAL MUCOSA IN THE DEPENDENCE OF AGE. *(Ger.)* Richter, V.; Borner, R.; Rotzsch, W. (Div. Medicine, Karl Marx Univ., Leipzig, Germany). *Z. Alternforschr.* 29(1):69-74, 1974.

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7302 PATHOPHYSIOLOGY AND DIETETICS OF SMALL INTESTINAL ANASTOMOSES AND RESECTIONS. *(Fr.)* Tremolieres, J.; Sautier, C. (no affiliation given). *Anesth. Analg. (Paris)* 31(6):909-920, 1974.

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7312 SERUM LEVEL ANTIBODIES TO BOVINE PROTEIN AND THE MORPHOLOGY OF SMALL INTESTINE MUCOSA IN CHILDREN. *(Pol.)* Hager-Malecka, B.; Pawelek-Krombholz, D.; Szaflarska, M.; Pieniazek, U. (Inst. Biol. Morphol., Silesian Med. Acad., Katowice, Poland). *Pol. Tgy. Lek.* 29(48):2073-2076, 1974.

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See also, 6990, 6991, 6998, 7013, 7050, 7054, 7069, 7097, 7164, 7174, 7199, 7207, 7275, 7276, 7277, 7351, 7352, 7353, 7354, 7359, 7362, 7371, 7386, 7407, 7449, 7498, 7523, 7529, 7537, 7543, 7557, 7603, 7703, 7764, 7824, 7825, 7845, 7850, 7855, 7864, 7865, 7867, 7870, 7878, 7880, 7889, 7910, 7945, 7974, 7975, 7985, 7990, 7992.

## SMALL INTESTINE

### Malabsorption

7351 FAILURE OF LABORATORY AND RADIOLOGICAL STUDIES TO PREDICT JEJUNAL MUCOSAL ATROPHY. *(Eng.)* Sanderson, M. C.; Davis, L. R.; Mowat, A. P. (King's Coll. Hosp., London SE5, England). *Arch. Dis. Child.* 50(7):526-531, 1975.

Fifty-eight infants and children in the early stages of malabsorption were investigated using special metabolic facilities. The data obtained were then compared with the results of small intestinal biopsy in order to assess the value of the preliminary investigations. The cases were allocated to one of two groups according to the small intestine histology: group I, normal histology 31 cases; group II, abnormal histology 27 cases. In group II, 22 patients had subtotal villous atrophy and five had partial villous atrophy. Of the 58 patients, 33 were under three yr of age, 25 above. The final diagnoses of those with a normal histology were: emotional deprivation and/or food refusal (seven), constitutional short stature (four), postgastroenteritis (three), recurrent respiratory infections (three), chronic diarrhea (three), giardiasis (two), habitual vomiting (two), normal child (two), inadequate breast feeding (one), iron deficiency with malabsorption (one), neurofibromatosis (one), dermatitis herpetiformis (one), eczema (one). A rise in blood glucose of less than 40 mg/ml was noted in 15 of 22 patients with abnormal mucosal histology. Rises of less than this were seen in more than 50% of those with normal histology. Fecal fat excretion in excess of 4.5 g/day was noted in 10 of 18 with abnormal histology. A xylose excretion of less than 20% was noted in more than 50% in both groups. Barium lactose examination showed a malabsorption pattern, and in some cases hypolactasis as well, in 13 of 16 with abnormal histology. Of 26 cases with normal histology, seven were abnormal on the barium studies, six of which were regarded as borderline. In patients with villous atrophy, 14 of 20 had a bone age more than 10% below the chronological age, while 13 of 29 with normal histology had a reduced bone age. More than half the patients with villous atrophy had a hemoglobin level of less than 11.5 g as against 25% of those with normal histology. Only two of 27 with normal histology had serum albumin levels of less than 3.5 g/100 ml, while nine of 24 with villous atrophy had low levels. Of 14 with villous atrophy, eight had a rise of triglycerides of less than 50 mg/100 ml; eight of 15 with normal histology had similar low rises. The results of these tests indicate that the application of a number of tests to show malabsorption in children suspected of having celiac disease is unrewarding. No investigation other than small intestine biopsy has shown with certainty the patients with mucosal atrophy and possible gluten enteropathy.

7352 INFLUENCE OF MIXTURES OF TAUROCHOLATE, FATTY ACIDS AND MONOLEIN ON THE TOXIC EFFECTS OF DEOXYCHOLATE IN RAT JEJUNUM IN VIVO. *(E.)* Lamabadusuriya, S. P.; Guiraldes, E.; Harries, J. T. (Inst. Child Health, 30 Guilford, London WC1N 1EH, England). *Gastroenterology* 69(2):463-469, 1975.

The influence of mixtures of taurocholate (TC), fatty acids and monolein (MO) on the inhibitory effects of deoxycholate was studied. In closed-loop studies, deoxycholate (DC) at 2.5 mM induced net secretion of $H_2O$, Na and Cl into the intestinal lumen. TC (20 mM) plus DC caused a reduction in the movement of $H_2O$ and Na, but not of Cl. A mixture of DC, TC and oleic acid (OA) caused a reduction in DC-induced secretion. Similar effects were noted with mixtures of DC and caprylic acid (CA), and/or MO. These effects were only partial and transport values remained different from controls except for Na. OA (10 mM) emulsions and TC (2.5 mM) had no effect on DC-induced secretion and 20 mM of TC had no effect on $H_2O$, Na or Cl movements. Inhibition of glucose transport by 5 mM of DC was abolished by a DC, TC and OA mixture. When a mixture of DC, TC and OA was perfused, the inhibition effects of DC were markedly reduced, with net secretion being reversed to net absorption. The reduction in transmural potential difference induced by 1 mM of DC was abolished by mixed micelle solutions. Deoxycholate produced significant inactivation of total and (Na-K)-ATPase and this effect was completely abolished by mixed micellar solution. These results indicate that the mechanism of micelle inactivation in DC action

may be a reduced access to jejunal membrane and/or a reduction in the relative concentrations of other bile salts and lipids within the intestinal lumen.

7353 ENTEROPATHY IN ADULT PROTEIN MALNUTRITION: LIGHT MICROSCOPIC FINDINGS. *(E.)* Duque, E.; Bolanos, O.; Lotero, H.; Mayoral, L. G. (Universidad del Valle Sch. Medicine, Apartado Aereo 1013, Cali, Colombia, South America). *Am. J. Clin. Nutr.* 28(8):901-913, 1975.

Intestinal morphological findings are presented in conjunction with severe, long-standing primary protein malnutrition. A total of 35 patients were studied (21 males and 14 females, aged 16-69 yr). All patients showed low values in all nutritional and absorptive parameters tested except fecal fat and serum vitamin $B_{12}$. Most showed slight or moderate abnormalities in intestinal mucosal pattern. Villus height decreased, with widening due to edema and inflammation. Total mucosal thickness was not affected. The mean number of mitoses/five crypts was directly proportional to crypt depth and these ratios were larger in several malnourished patients. A thickening of the epithelial basement and perivascular membranes was observed in 24 of 35 cases. A mononuclear infiltration of the lamina propria was present in all patients. Protein repletion acheived amelioration of both the clinical and histologic abnormalities in all but one patient. The two main findings that characterize the state of severe malnutrition are reduction in intestinal mucosal thickness and atrophy of the crypts. The mild enteropathy of severe protein malnutrition must be considered in the differential diagnosis of malabsorption in the tropical setting. It is concluded that adequate classification of the biopsies and careful histometric evaluation is required.

7354 ENTEROPATHY IN ADULT PROTEIN MALNUTRITION: ULTRASTRUCTURAL FINDINGS. *(E.)* Duque, E.; Lotero, H.; Bolanos, O.; Mayoral, L. G. (Universidad del Valle Sch. Medicine, Apartado Aereo 1013, Cali, Colombia, South America). *Am. J. Clin. Nutr.* 28(8):914-924, 1975.

The intestinal ultrastructure of severely malnourished adults with primary (dietetic) protein malnutrition is reported. In all nine patients studied (six males, three females), the biopsies showed varying abnormalities of the absorptive cells. These abnormalities included microvilli slightly shortened, small in number and deviating from the vertical position. No correlation was found between the degree of these abnormalities and the severity of the protein malnutrition or malabsorption. In eight of nine cases, in the subepithelial region a dense, finely granular material was noted, accompanied by collagen fibers immediately below the basement layer. In some areas these deposits and collagen appeared to be united, forming a "complex" between the epithelial and capillary membranes. These findings were believed to be nonspecific, but represented a secondary response to chronic inflammation caused by abnormal intestinal bacterial flora.

7355 ANTI-RETICULIN ANTIBODY IN JEJUNAL JUICE IN CELIAC DISEASE. *(E.)* Mawhinney, H.; Love, A. H. G. (Dept. Medicine, Queen's Univ. of Belfast, Belfast BT12 6BN, Northern Ireland). *Clin. Exp. Immunol.* 21(3):394-398, 1975.

Analysis was made of samples of jejunal juice from 14 untreated celiac patients (four men and 10 women, aged 14-69 yr), from 12 patients (five men and seven women, aged 14-59 yr) with normal jejunal biopsies, and from 10 normal control subjects (six men and four women, aged 23-35 yr). The results of the investigation showed that it was possible to demonstrate anti-reticulin antibody in jejunal juice. This antibody was demonstrated only in the immunoglobulin A (IgA) class. IgA anti-reticulin antibody was present in eight of 14 (57%) patients with untreated celiac disease, one of 12 (8%) in the normal biopsy group, and in none of the 10 controls. The presence of anti-reticulin antibody in jejunal juice suggests that this antibody arises as a result of stimulation of the secretory immune system. As the various parts of the secretory immune system function independently, the presence of anti-reticulin antibody in jejunal juice must result from antigenic stimulation of the immunocompetent cells of the small intestine. This supports the theory that reticulin behaves as a dietary protein antigen in celiac disease. Anti-reticulin antibody in the present study differs from antibodies to dietary protein antigens, such as gluten and cow milk proteins, in that antibodies to these proteins have been demonstrated in the jejunal juice not only of celiac patients but also of many subjects with normal jejunal biopsies as well as normal control subjects.

7356 THE IMMUNOGLOBULIN CLASS RESPONSES TO ORAL POLIOVACCINE IN COELIAC DISEASE. *(E.)* Mawhinney, H.; Love, A. H. G. (Dept. Medicine, Queen's Univ. of Belfast, Belfast BT12 6BN, Northern Ireland). *Clin. Exp. Immunol.* 21(3):399-406, 1975.

By means of an indirect immunofluoresent technique, the incidence and immunoglobulin (Ig) class distribution of the serum antibody response to type II p. o. polio vaccine was studied in 38 patients (22 women and 16 men, aged 15-72 yr) with adult celiac disease and compared with matched control subjects. Of the 38 patients, 19 (50%) showed an antibody response compared with only seven of 38 control subjects (18%). In 16 of the 38 patients (42%) poliovirus-specific IgA responses were noted, compared with 7 of 38 controls (18%). Poliovirus-specific IgG responses were seen in only 10 of 38 patients (26%) and four of 38 controls (11%). No poliovirus-specific IgM responses were observed. There was no evidence of any difference in the magnitude of the poliovirus-specific IgA or IgG responses in the celiac and control group subjects. The preimmunization poliovirus-specific IgA titers of those who showed an antibody response were significantly higher in the celiac than in the control group. The most striking difference between the patients with celiac disease and the control subjects was the much higher incidence of antibody responses to challenge with p.o. poliovaccine in the group of celiac patients. The explanation for this phenomenon is not known at present.

7357 CHYLOUS ASCITES AND INTESTINAL MUSCULAR HYPERTROPHY OCCURRING IN THE COURSE OF CELIAC SPRUE. *(E.)* Kaufmann, H. J. (Katonah Med. Group, N.Y.). *Am. J. Dig. Dis.* 20(5):494-497, 1975.

A 57-yr-old male presented with a 6 yr history of episodic abdominal pain, bloating, and diarrhea, with an associated 10 pound weight loss. Four years earlier an oral cholecystogram showed nonfunction, and a cholecystectomy revealed no abnormalities of the abdominal contents except for an inflammed noncalculous gallbladder. Three years later, exploratory laparotomy showed a milky-white fluid in the abdominal cavity which did not show malignant cells, but did show cholesterol crystals on microscopic examination. The entire small intestine was distended and hypertrophied and showed increased peristaltic activity from the ligament of Treitz to the ileocecal valve. On the present admission X-rays of the gastrointestinal tract with barium showed a dilated but normal colon and a diffusely abnormal small intestine, with dilatation and thickening of the valvulae conniventes. A biopsy of the proximal jejunum with a Crosbly capsule showed a virtually flat mucosa, marked inflammation of the lamina propria, and cuboidal epithelial cells. Treatment with a gluten-free diet brought about improvement in his symptoms. A few months later, tetracycline, 1 g daily, was given due to the presumption that stasis with secondary bacterial overgrowth was present, causing some repeated attacks. Six months later, suspecting an ulcerated area of bowel or a tumor might be causing his bouts of apparent obstruction, a second laparotomy was performed. The proximal half of the small intestine was markedly thickened and dilated. The distal half of the small intestine was almost normal. The colon was dilated. Two large mesenteric nodes were present, the larger of which was microscopically normal. The most striking feature was the great thickening of the muscular layers, which measured 4 mm in the fixed state. The mucosa was consistent with treated celiac sprue. The use of tetracycline was gradually discontinued and the only episodes of pseudoobstruction which now occur seem to follow inadvertent ingestion of gluten. This patient showed the development of chylous ascites in the course of celiac sprue and disappeared on treatment. Its presence was probably related to the mesenteric nodal hyperplasia which is known to occur in celiac sprue.

7358 THE IMMUNE RESPONSE TO $\phi$X 174 IN MAN. III. EVIDENCE FOR AN ASSOCIATION BETWEEN HYPOSPLENISM AND IMMUNODEFICIENCY IN PATIENTS WITH COELIAC DISEASE. *(E.)* Baker, P. G.; Jones, J. V.; Peacock, D. B.; Read, A. E. (Univ. Bristol, Dept. Medicine, Bristol BS10 5NB, England). *Gut* 16(7): 538-542, 1975.

The coliphage $\phi$X 174 was used to study antibody production in coeliac disease. In all eight cases studied the diagnosis was based on histological changes of subtotal villous atrophy in the jejunal biopsy. Three cases showed a gross impairment of the primary response with a peak antibody level of less than 20. There were no significant changes in the other five cases as to appearance of antibody, rate of titer increase, height and time of peak response or rate of antibody decline. There was considerable impairment in the secondary response. There was a correlation between the severity of the disease and the depression of antibody production. Spleen size was below normal in five of the cases. Serum IgM levels in three cases were abnormally high. It was concluded that patients with coeliac disease have a depressed ability for antibody production with a defect in switching from IgM to IgG antibody.

7359 CHRONIC CELIAC DISEASE COMPLICATED BY A PRIMARY RETICULUM CELL SARCOMA OF THE SMALL INTESTINE. *(Fr.)* Rutsaert, J.; Mainguet, P.; Bleiberg, H. (Faculte Medecine Pharmacie, 97, rue aux Laines, Bruxelles, Belgique). *Ann. Anat. Pathol. (Paris)* 19(3):299-310, 1974.

A 33-yr-old patient with celiac disease was the basis of this study. The onset of the illness was in infancy; no specific treatment was recommended during childhood. At 21 yr a gluten-free diet was prescribed. At the age of 31, abdominal pains, diarrhea and x-ray confirmation led to the diagnosis of duodenal stasis which called for exploratory laparotomy. No tumor was found and a duodenojejunostomy was performed. At 32 yr, diarrhea, fever and an inflammatory state were observed. A jejunal biopsy showed severe atrophy of the villi, a month after which an acute abdominal syndrome ensued. Numerous perforated tumors of the jejunum identified as reticulum cell sarcoma and an ileo-cutaneous fistula were discovered. At the age of 33 the patient died in a state of advanced cachexia. A tumoral mass adherent to the spleen, the stomach and the colon was autopsied from the left hypochondrium. A second stomach perforation was discovered, as well as generalized hepatic angiomatosis, and arterial and renal calcifications. Hypotheses were advanced as to the cause of the sarcoma in celiac patients, such as the action of radiation, pre-cancerous state of the atrophic intestinal mucosa, penetration of carcinogenic foods or micro-organisms in an already overstressed mucosa, or possibly an immunologic deficiency. There exists a very probable link between celiac disease and intestinal sarcoma, the pathogenesis of which is still unknown.

7360 ENTEROTOXIGENIC INTESTINAL BACTERIA IN TROPICAL SPRUE. III. PRELIMINARY CHARACTERIZATION OF *Klebsiella pneumoniae* ENTEROTOXIN. *(E.)* Klipstein, F. A.; Engert, R. F. (Univ. Rochester Medical Center, 601 Elmwood Ave., Rochester, N.Y.). *J. Infect. Dis.* 132(2):200-203, 1975.

The enterotoxin secreted by a strain of *Klebsiella pneumoniae* serotype 5, which was the predominant organism cultured from the midjejunal aspirate of a Puerto Rican with tropical sprue, was characterized. Cell-free broth filtrates were prepared by stationary aerobic incubation of cultures in trypticase soy broth. The crude filtrates were freeze-dried, after which portions were heated (100 C for 30 min), treated with acid (pH 4.4), dialyzed through viscose tubing,

or subjected to acetone precipitation followed by sequential passage through Diaflo membranes. The various preparations were tested in the ileal loops of 8 to 12-week-old coccidia-free rabbits. The cell-free filtrates retained their capacity to induce fluid secretion in the rabbit ileal loops after heating, acid treatment and dialysis. The acetone precipitate also produced a positive response, which was increased in the ultrafiltration membrane (UM) 2 retentate; the UM 2 filtrate was comparatively less active in this respect, and the UM 10 retentate was inactive. Increasing purification of the *K. pneumoniae* broth filtrate material was associated with a progressive fall in the osmolality of the active fractions. The UM 2 retentate produced a positive fluid response in the ileal loop model when dissolved in isotonic solution. The data indicate that the enterotoxin elaborated by *K. pneumoniae* resembles the previously characterized heat-stable enterotoxin of *E. coli* in a number of respects.

7361 THERAPY OF THE MALABSORPTION SYNDROME. *(Ger.)* Blum, A. L.; Krejs, G. J. (Municipal Hosp. Triemli, Zurich, Switzerland). *Therapiewoche* 25(12):1459-1468, 1975.

7362 THE PATHOPHYSIOLOGICAL ROLE OF THE SMALL INTESTINAL BACTERIAL FLORA IN THE "STAGNANT LOOP SYNDROME". *(Ger.)* Hoffgen, K. U.; Wirth, K. (Zentrum fur Innere Medizin der Jostus-Liebig Universitat Giessen, Germany). *Med. Klin.* 70(17): 760-765, 1975.

7363 PHYSIOLOGY AND PATHOLOGY OF VITAMIN $B_{12}$ ABSORPTION. *(Fr.)* Dedieu, P. (Univ. Hosp. Center, Nantes, France). *Arch. Fr. Mal. App. Dig.* 64(1):65-82, 1975.

7364 CLINICAL SIGNS OF THE MALABSORPTION SYNDROME. *(Ger.)* Strohmeyer, G.; Gottesburen, H. (Medical Clinic II, Dusseldorf, Germany). *Therapiewoche* 25(12):1410-1418, 1975.

7365 PROGRESSIVE REFRACTORY THERAPY IN MALABSORPTION. *(Ger.)* Rosch, W.; Morl, M.; Becker, V. (Medical Clinic, Univ. Erlangen-Nuremberg, Erlangen, Germany). *Fortschr. Med.* 93(14):738-743, 1975.

7366 MALABSORPTION SYNDROME: MORPHOLOGICAL ASPECTS. *(Ger.)* Riecken, E. O. (Medical Clinic, Univ. Marburg, Marburg, Germany). *Therapiewoche* 25(12):1419-1423, 1975.

7367 SPECIAL INQUIRY INTO VITAMIN METABOLISM IN MALABSORPTION SYNDROME. *(Ger.)* Castrillon-Oberndorfer, W. L. (Medical Clinic, Univ. Tubingen, Germany). *Therapiewoche* 25(12):1424-1430, 1975.

7368 BLIND LOOP SYNDROME AND HYPOCHROMIC ANEMIA: LATE COMPLICATIONS OF LATERO-LATERAL INTESTINAL ANASTOMOSIS. *(Sp.)* Cario, A. A.; Uribe, M.; Bravo, J. L.; Rosa, C. (Dep. Gastroenterol., Nat. Inst. Nutrition, Mexico 22, D.F.). *Rev. Invest. Clin.* 27(1):47-53, 1975.

7369 PHYSIOPATHOLOGY OF INTESTINAL ABSORPTION. *(Sp.)* Bueno Gomez, J. (no affiliation given). *Rev. Esp. Enferm. Apar. Dig.* 45(5):586-590, 1975.

7370 HEREDITARY DEFICIENCY OF ISOMALTASE AND SACCHARASE RESPONSIBLE FOR A MALABSORPTION SYNDROME. *(Ger.)* Niessen, K. H.; Brugmann, G.; Schmidt, K. (Universitats-Kinderklinik, 74 Tubingen, Rumelinstrasse 23, Bundesrepublik Deutschland). *Klin. Paediatr.* 187(2):163-170, 1975.

7371 EVALUATION OF CARBOHYDRATE METABOLISM IN PATIENTS WITH THE BLIND LOOP SYNDROME (BLS) BY A C-XYLOSE BREATH TEST. *(E.)* Spivey, J.; Lorenz, E.; Mauderli, W.; Toskes, P. (VA. Hosp., Gainesville, Fla.). *Gastroenterology* 68(4):1001, 1975.

7372 HYPEROXALURIA CORRELATES WITH STEATORRHEA IN PATIENTS WITH CELIAC SPRUE. *(E.)* McDonald, G. B.; Earnest, D. L.; Admirand, W. H. (Dep. Med., Univ. Washington, Seattle, Wash.). *Gastroenterology* 68(4):949, 1975.

7373 TROPICAL SPRUE (TS) IN SOUTHWESTERN COLOMBIA: EXPERIENCE IN 10 YEARS. *(E.)* Mayoral, L. G.; Bolanos, O.; Lotero, H.; Duque, E. (Valle Med. Sch., Cali, Colombia). *Gastroenterology* 68(4):948, 1975.

7374 EFFECT OF TROPICAL SPRUE ON HYDROLYSIS AND ABSORPTION OF CONJUGATED FOLATE. *(E.)* Halsted, C. H.; Reisenauer, A. M.; Corcino, J. J. (Dep. Med., Univ. California, Davis, Calif.). *Gastroenterology* 68(4):908, 1975.

7375 LONG-TERM HOME PARENTERAL NUTRITION (PN). *(E.)* Orringer, E. P.; Heizer, W. D. (Dept. Med., Univ. North Carolina, Chapel Hill, N.C.). *Gastroenterology* 68(4):910, 1975.

7376 IgA DEFICIENCY IN ADULTS WITH LACTOSE INTOLERANCE PRESENTING AN "IRRITABLE BOWEL SYNDROME". *(E.)* Gluckman, J. B.; Schenk, E. A. (Univ. Rochester Sch. Med., Rochester, N.Y.). *Gastroenterology* 68(4):901, 1975.

7377 IN VITRO PROTECTION BY CORTISOL AGAINST THE DELETERIOUS EFFECT OF GLUTEN IN GLUTEN-SENSITIVE ENTEROPATHY. *(E.)* Katz, A. J.; Strober, W.; Shwachman, H.; Falchuk, Z. M. (Child. Hosp. Med. Cent., Boston, Mass.). *Gastroenterology* 68(4):890, 1975.

7378 BRUSH BORDER MEMBRANE ENZYMES IN MORBID OBESITY. *(E.)* Cerda, J. J.; O'Leary, J. P.; Agresti, H. (Univ. Florida Coll. Med., Gainesville, Fla.). *Gastroenterology* 68(4):872, 1975.

7379 WHIPPLE'S DISEASE. REPORT OF A CASE CHARACTERIZED BY RECURRENT LEFT-SIDED PLEURAL EXUDATE. *(Dan.)* Andersen, C. W. (Amtssygehuset, Astersvej 31, 2, DK-4600 Koge, Denmark). *Ugeskr. Laeger* 137(5):264-267, 1975.

7380 TWO CASES OF ACQUIRED DISACCHARIDE INTOLERANCE WITH EXCEPTIONALLY SEVERE COURSES. *(Pol.)* Siewierska, B. (S. Popowski Provincial Pediatric Hosp., ul. Zolnierska 18, 10-561, Olsztyn, Poland). *Wiad. Lek.* 28(7):579-583, 1975.

7381 A CASE OF WHIPPLE'S DISEASE COMPLICATED BY AMYLOIDOSIS. *(Pol.)* Biernat, S.; Kozlowski, W. (Provincial Acad. Medicine, 90-647 Lodz, Plac 9 Maja, Poland). *Pol. Tyg. Lek.* 30(3):113-115, 1975.

7382 IRON-DEFICIENCY ANEMIA IN CHILDREN WITH MALABSORPTION SYNDROME. *(Pol.)* Wroblewska-Kaluzewska, M.; Leskiewicz, W.; Fijalkowska, A. (Acad. Medicine, ul. Marszalkowska 24, 00-576, Warsaw, Poland). *Pediatr. Pol.* 50(3):301-308, 1975.

7383 LACTIC AND BUTYRIC DEHYDROGENASE ACTIVITY IN CELIAC DISEASE AND GIARDIASIS IN CHILDREN. *(Pol.)* Tuszkiewicz-Misztal, E. (Acad. Medicine, ul. Staszica 11, 20-081 Lublin, Poland). *Pediatr. Pol.* 50(4):417-422, 1975.

7384 SUCROSE MALABSORPTION IN CHILDREN. THE CLINICAL SIGNIFICANCE OF THE DIAGNOSIS. *(Dan.)* Gudmand-Hoyer, E.; Krasilnikoff, P. A. (Kobenhavn amts sygehus, Gentofte, Denmark). *Ugeskr. Laeger* 137(15):841-844, 1975.

7385 THE EFFECT OF PHOTOTHERAPY IN PREMATURE AND MATURE INFANTS. A COMPARATIVE INVESTIGATION. *(Dan.)* Ebbesen, F. (Centralsygehuset, Naestved, Denmark). *Ugeskr. Laeger* 137(5):262-264, 1975.

7386 THE PATHOPHYSIOLOGICAL ROLE OF THE SMALL INTESTINAL BACTERIAL FLORA IN THE "STAGNANT LOOP SYNDROME." *(Ger.)* Hoffgen, K. U.; Wirth, K. (Zentrum fur Innere Medizin, Justus-Liebig-Universitat, Giessen, Germany). *Med. Klin.* 70(17):760-765, 1975.

7387 FINDINGS IN THE MUCOSA OF THE SMALL INTESTINE WHICH ARE RELATED TO THE TREATMENT OF PATIENTS WITH VARIOUS STAGES OF CELIAC DISEASE. *(Ger.)* Fiehring, C.; Vollmar, F.; Konig, K.; Koslowski, H.; Jung, G.; Menzel, K.; Wedekind, U. (Medizinische Akademie, DDR-50 Erfurt, Am Schwemmbach 32a, Germany). *Dtsch. Z. Verdau. Stoffwechselkr.* 34(5/6):341-352, 1974.

7388 MALABSORPTION AND HEPATIC CHANGES. *(Ger.)* Fiehring, C.; Vollmar, M.; Braun, W.; Koslowski, H.; Konig, K. (Medizinische Akademie, DDR-50 Erfurt, Am Schwemmbach 32a, Germany). *Dtsch. Z. Verdau. Stoffwechselkr.* 34(5/6):307-312, 1974.

7389 STUDY OF CELIAC DISEASE: 68 CASES. *(Fr.)* Wackenier, J. P.; Simar, J.; Goor, M.; Houcke, M.; Farriaux, J. P.; Fontaine, G. (Cite Hospitaliere, 59000 Lille, France). *Rev. Pediatr.* 11(1):21-34, 1975.

7390 STRUCTURAL AND FUNCTIONAL CHANGES IN THE SMALL INTESTINE IN DERMATITIS HERPETIFORMIS. *(Ger.)* Kryszewski, A.; Zoltowska, A.; Pawlik, H. (Medical Academy, Gdanzk, Poland). *Hautarzt* 26(3):133-136, 1975.

7391 STEATORRHEA: PATHOPHYSIOLOGICAL, DIAGNOSTIC, AND THERAPEUTIC ASPECTS WITH CONSIDERATION OF RECENT FINDINGS ON BILE ACID METABOLISM. *(Ger.)* Schentke, K. U. (Medizinische Akademie "Carl Gustav Carus," 8019 Dresden, Fetscherstrasse 74, Germany). *Z. Aerztl. Fortbild.* 69(5):225-229, 1975.

7392 SMALL-INTESTINAL HISTOLOGY IN COELIAC DISEASE. *(E.)* Challacombe, D. N.; Dawkins, P. D.; Baylis, J. M.; Robertson, K. (Taunton Somerset Hosp., Taunton, Somerset, TA1 5DA, England). *Lancet* 1(7920):1345-1346, 1975.

7393 WHEN DOES LACTOSE MALABSORPTION MATTER IN ADULTS? *(E.)* Anonymous. (No affiliation given). *Br. Med. J.* 2(5967):351-352, 1975.

See also, 6656, 7010, 7326, 7328, 7334, 7335, 7338, 7501, 7703, 7852, 7853, 7854, 7873, 7880.

## LARGE INTESTINE

7394 WHAT DO WE GAIN FROM THE SIXTH STOOL GUAIAC? *(E.)* Neuhauser, D.; Lewicki, A. M. (Harvard Sch. Publ. Health, Boston, Mass.). *N. Engl. J. Med.* 293(5):226-228, 1975.

The marginal cost involved in implementing the six sequential stool guaiac protocol of Greegor for screening of colonic cancer was analyzed. The expected yield of true-positive results from six se-

quential guaiac tests was calculated for a population of 10,000 people of whom 72 were assumed to have colonic cancer. A two guaiac protocol would have a true positive rate of 99.31% and a false positive rate of 59.69%. There was little gain in the true positive rate from testing beyond the second guaiac examination, but there was a steadily rising rate in the false positive group with more frequent testing. Analysis of the expenditures involved in such a program showed that the cost of detecting cancer rose exponentially so that the marginal cost of the sixth test may be 20,000 times the average cost. The marginal cost was decreased with lower test sensitivity and increased with lower prevalence of colonic cancer. The results show how an inexpensive test can become quite expensive if it is to be made available to a larger population group. This high cost is incurred with only a small gain in terms of additional cancer found by the last few guaiac tests of this program. Intuitively, it may then seem more profitable to proceed immediately to the barium enema examination, a completely accurate, if more expensive, procedure that needs to be done only once. The marginal cost/case detected depends on the prevalence of the condition in the population screened and the sensitivity of the test applied.

7395 FACTORS AFFECTING THE CONCENTRATION OF COMBUSTIBLE GASES IN THE COLON DURING COLONOSCOPY. *(E.)* Bond, J. H., Jr.; Levitt, M. D. (Veterans Admin. Hosp., Minneapolis, Minn. 55417). *Gastroenterology* 68(6):1445-1448, 1975.

The concentrations of $H_2$ and $CH_4$ in colonic gas obtained through the colonoscope at the time of colonoscopy were measured in 60 consecutive patients, and the effects of liquid diet, fasting, and bowel cleansing on the rate of production of those colonic gases were assessed. The colonic concentrations of $H_2$ and $CH_4$ were well below hazardous levels in all patients at the time of colonoscopy. The mean concentration of $H_2$ was 0.024% ± 0.007% and of $CH_4$ was 0.0023% ± 0.001%. The highest concentration of either gas encountered was only about 1/20 of the minimal explosive concentration. These low values could be the result of the colonoscopy preparation procedure and/or dilution with air introduced during colonoscopy. The patient preparation procedure was analyzed by measuring excretion of $H_2$ and $CH_4$ in 10 subjects undergoing routine colonoscopy preparation, in five subjects ingesting the low residue liquid diet for 48 hr, in 10 volunteers who fasted for 12 hr, and in two volunteers undergoing the colonic cleansing procedure used for colonoscopy. Hydrogen excretion fell precipitously to about 10% of basal values after 24 hr on a liquid diet and showed a further decline to 5% of the preparation level at the time of colonoscopy. In contrast, $CH_4$ fell to about 60% of basal levels at day one; however, just prior to colonoscopy, $CH_4$ excretion had declined to only about 15% of the basal level. In patients on a low-residue liquid diet, $H_2$ excretion rapidly fell to low levels; however, $CH_4$ excretion was minimally reduced. Fasting resulted in a 15-fold reduction in $H_2$ excretion, but only a 26% fall in $CH_4$. Bowel cleansing reduced both $H_2$ and $CH_4$ 10-fold. The results do not support the need for routine $CO_2$ insufflation prior to colonoscopic electrosurgical polypectomy.

7396 PROBABILISTIC APPLICATION OF PLASMA CARCINOEMBRYONIC ANTIGEN ASSAY IN CANCER PATIENTS. *(E.)* Ashman, L. K.; Ludbrook, J.; Marshall, V. R. (Dep. Surg., Univ. Adelaide, Adelaide 5000, South Australia). *Br. Med. J.* 2(5973):721-724, 1975.

In an attempt to establish a more appropriate control group, carcinoembryonic antigen (CEA) levels were determined in patients proved after death to be cancer-free, as the basis against which to compare levels in cancer patients. Plasma samples were assayed for CEA activity in 114 subjects, including 21 healthy volunteers, mean age 24.1 yr, male:female ratio, 1.1:1; 23 patients without cancer, mean age 59.5 yr, male:female ratio, 2.8:1; and 64 cancer patients, mean age 68.4 yr, male:female ratio, 2.2:1. Tumors in this group originated in the lung (22), colon (14), rectum (10), prostate (seven), pancreas (six) and stomach (five). Two radioassay procedures were used: the Roche assay and an assay developed in this laboratory. The mean plasma CEA concentrations in healthy controls by the first technique was 2.42 µg/ml, and by the second, 6.30 µg/ml, and neither group differed significantly from normal. Patient controls had a significantly greater mean CEA level than healthy controls by both procedures. Of 64 cancer patients, 19 by the second assay and 18 by the first assay had plasma CEA levels above the upper 90% confidence limit. When compared with healthy controls, 50 were in this range. Of 19 patients with plasma CEA levels corresponding to a better than 95% probability of cancer, three had disease confined to the organ of origin, four had lymph node involvement and 12 had distant metastases. These data indicate that CEA results should be expressed in probabilistic terms, rather than with the use of a simple cutoff.

7397 COMPARATIVE ELECTRON MICROSCOPIC FEATURES OF NORMAL, HYPERPLASTIC, AND ADENOMATOUS HUMAN COLONIC EPITHELIUM. II. VARIATIONS IN SURFACE ARCHITECTURE FOUND BY SCANNING ELECTRON MICROSCOPY. *(E.)* Fenoglio, C. M.; Richart, R. M.; Kaye, G. I. (Coll. Physicians Surgeons, Columbia Univ., New York, N.Y.). *Gastroenterology* 69(1):100-109, 1975.

The architecture and surface cytoplasmic features of the mucosa of normal colon, hyperplastic polyps, and colonic adenomas were studied by scanning electron microscopy. Thirteen hyperplastic polyps and 15 adenomas were taken from patients, along with adjacent normal colonic mucosa. Specimens were fixed in glutaraldehyde and coated with gold-palladium. After scanning, they were reprocessed and stained for light microscopy. Scanning electron microscopy showed the surface architecture of normal colonic mucosa to be arranged in interconnecting territories containing 20-100 crypt mouths each, in parallel linear arrays, separated by deep clefts. Areas were covered by mucinous secretions from the crypt mouths. The hyperplastic polyps were heavily coated with mucinous secretion. In the transition zone to normal mucosa, a similar territorial configuration but in an exager-

rated form was seen. Thick cord-like elevations of the surface tapered into a flattened zone which appeared to have lost its normal architecture due to stretching. Nonvillous adenomas had anastomosing cerebriform epithelial cords surrounding deep epithelial depressions that were too wide to be crypt mouths. No normal crypts were identified. When the adenomas were pedunculated, the stalks were normal mucosa. Villous adenomas had more prominent convoluted cerebriform anastomosing ridges separated by deep clefts. In cell arrangement and cytological features, the normal mucosa was coated with an irregular lining of absorptive epithelium with occasional dispersed goblet cells. The lining cells of the crypt appeared to be arranged in overlapping spirals or rings. The tops of the absorptive cells appeared as pentagons covered with closely packed microvilli, while some cells protruded from the surface and had taller, more widely spaced microvilli. There were all gradations between the two types. The microvilli had clubbed tips, possibly an artifact. In the hyperplastic polyps, the polygonal tops of the absorptive cells were stretched into elliptical shapes, especially on the lateral polyp surfaces. Goblet cells were absent at the free surfaces, and absorptive cell microvilli were twice normal size. The polypoid and villous adenomas had nearly total absence of surface goblet cells, but hypersecretory villous adenomas had greater than normal numbers of them. Most adenoma cells were smaller than normal, and departed from the normal polygonal shape. There were occasional large surface cells. Most absorptive cells had short, blunt microvilli, but in some they were elongated fanned tufts. It is concluded that there are divergent patterns of surface morphology in hyperplastic and adenomatous mucosa.

7398 INVESTIGATIVE MEASURES IN DIVERTICULAR DISEASE: RADIOLOGY COLONOSCOPY. *(E.)* Samuel, E.; Dean, A. C. B. (no affiliation given). *Clin. Gastroenterol.* 4(1):71-84, 1975.

Investigative procedures to demonstrate presence of diverticular disease and to exclude other colonic disease are discussed. In radiological diagnosis, barium enema is the keystone. The diverticula often fail to fill when the barium is administered by mouth. The colon should be cleansed thoroughly, followed by an enema of 1:4 barium sulfate solution after one hr. Injection of air after evacuation is not recommended. The filled diverticulum appears as a flask-shaped projection from the lumen. A spiculated outline of the colon indicates overactivity and thickening of the musculature. Complicating inflammatory change in the diverticular area can only be made with certainty when peri- or paracolic abscess formation or fistulae into another viscus is present. When barium studies have shown some dubiety, such as a narrow irregular segment associated with the diverticula, then colonoscopy is indicated. As with radiology, this should not be carried out until about six weeks after an acute attack of diverticulitis. Regular 10 ml doses of $MgSO_4$ should be given three times daily for 48 hr prior to examination to facilitate cleansing. At sharp bends with narrow lumens, the instrument may be pushed forward, rotating to and fro in a zig-zag fashion, even when out of direct vision. The uninflamed diverticulum appears as an oval portal lying in normal mucosa, revealing a shadowy cavern beyond. When inflammation is present, it may appear only as a small pit or depression in the swollen mucosa. Differential diagnosis of carcinoma by radiology is difficult when a scirrhous carcinoma distorted by diverticula is present, and must be distinguished from muscular hypertrophy, inflammatory stricture, and pericolic abscesses. With colonoscopy, there is a high failure rate because the instrument may not pass through the narrowed portion. Transintestinal intubation provides a possible solution. Colonoscopy and frozen section biopsy can be performed during laparotomy. Differential diagnosis of Crohn's disease is a less common problem. Symptoms of diarrhea, rectal bleeding and perianal abscess or fistula are suggestive of Crohn's disease. Biopsy and colonoscopy may be helpful. Perforation with peritonitis is the commonest complication of diverticular disease, followed by localized paracolic abscesses and fistulae to the bladder, or the vagina, small bowel, or anterior abdominal wall. Hemorrhage occurs rather uncommonly and usually responds to conservative treatment. Etiology of the disease through radiological and pressure studies is believed to stem from spasm or hypertrophy of the circular muscle, or its crowding by contraction of the longitudinal muscle.

7399 DIVERTICULAR DISEASE OF THE COLON, A 20TH CENTURY PROBLEM. *(E.)* Painter, N. S.; Burkitt, D. P. (no affiliation given). *Clin. Gastroenterol.* 4(1):3-21, 1975.

The history of colonic diverticular disease, its geographical prevalence, and a hypothesis of its etiology is presented. The disease was not recognized as a clinical problem until about 1900 and surgical cure not practiced until 1942. In the early 1960s the pathology of the disease was linked to high intracolonic pressures. Parenteral morphine injections were found to cause diverticulum-bearing segments of the sigmoid to produce greater pressures (sometimes over 90 mm Hg) than normal segments in the same patient. Cineradiography showed high localized pressures were produced by segmentation of the colon, regardless of the type of stimulus. Prediverticular colons produced higher pressures than normal ones, indicating a primary inward disturbance of motility that resulted in diverticular formation secondarily. A close relationship was found between incidence of the disease and economic development of the geographical area. The disease is almost unknown in Africa, very rare in India and the Middle East, Singapore, Malaysia, Korea, Bangkok, and southern Spain. The diet in these countries contains more fiber than the refined foods of industrialized countries where the disease commonly occurs. The American negro has become increasingly prone to the disease as increasing prosperity has led to his eating less maize, and the high incidence of the disease in Japanese born and bred in Hawaii compared with those living in Japan is accompanied by similar dietary changes. It is hypothesized that a diet containing adequate fiber will pass through the gut in 48 hr (1/2 the time of a refined diet). The gut therefore has less time to absorb water, the fecal stream is not as viscous and the colon need not build up as much pressure as for

the viscous low fiber diet. Patients with symptomatic diverticular disease were given a high fiber diet containing miller's bran and reduced sugar. Abdominal pain and distension were relieved in over 85% of the 70 patients. Those who defecated once a week with effort passed soft stools every day. It is concluded that diverticular disease is due to fiber deficiency in the diet.

7400 NATURAL HISTORY OF DIVERTICULAR DISEASE OF THE COLON. *(E.)* Parks, T. G. (no affilation given). *Clin. Gastroenterol.* 4(1):53-69, 1975.

The course and prognosis of symptomatic diverticular disease is reviewed. The incidence increases with age, rising from 5% in the fifth decade to about 50% in the ninth. In one study, 7.7% of patients with the disease were in their ninth decade before presenting with symptoms. Mortality and morbidity are higher in older persons; in one study 20% of all patients in their sixth decade had radiological evidence of diverticulitis compared with 33% of the patients in their ninth. Several surveys found 1.7%, 4.8%, and 2.3% of patients under 40 yr of age. In younger persons it is often aggressive, associated with more troublesome symptoms, and a high complication rate. Studies early in the century showed a preponderance of males (1.6:1 to 3:1) but in the past 30 yr there has been a female preponderance or no differential. Generally, patients with many diverticula were older than those with few. However, the disease does not necessarily progress with age. Many patients also had no increase in diverticular size in 10 yr. There is little evidence that probability of recurrence of diverticulitis and incidence of complications are directly proportional to the number of diverticula. In over 90% of all patients, the sigmoid is the segment affected, and in 45-65%, it is the only segment affected. It has been shown that over 2/3 of the patients are not condemned to relentless advance of the disease; resection is often curative. Patients with extensive or total involvement are no older on the average than those with the disease localized to the sigmoid. Prognosis is related to pathological development in the distal left colon, but not to the more proximal disease. In one study, over 90% of diverticulitis operations involved the sigmoid. Incidence of diverticulitis or peridiverticulitis can be accurately assessed, but has been estimated at 10-20% of patients with diverticula. In one series, 50% of the patients had no symptoms until less than one month prior to referral, and 75% had symptoms less than one yr. Another survey showed 75% of all deaths from the disease occurred in patients who had symptoms less than one month. Of 294 patients, over 50% had symptoms over one yr. Another study showed 45% with symptoms less than one yr and 83% less than five yr. Correlation between symptoms and pathological findings was generally poor. Prognosis was related to symptoms, localized pain giving a better prognosis than generalized pain. Abdominal pain was the commonest symptom in cases requiring hospitalization. Disturbance of bowel habit, nausea and vomiting, distention, and a palpable mass were associated with poorer prognosis. About 40-45% develop recurrent attacks. A high residue diet was effective in treating 80% of 62 patients. In a study of those given resections, 95.6% remained cured (follow-up from 1-16 yr). Proximal colostomy is of limited value in the long term. Closure of colostomy without resection has a high failure rate. Mortality during first hospital stay is about 3%, but may be over 10% when complications are present.

7401 PATHOLOGY OF DIVERTICULAR DISEASE OF THE COLON. *(E.)* Morson, B. C. (no affiliation given). *Clin. Gastroenterol.* 4(1):37-52, 1975.

Diverticular disease occurs in about one of every three people over 60 yr of age in Europe, North America, and Australia. The diverticula consist of a pouch of mucous membrane projecting through the circular muscle layers into the pericolic fat and appendices epiploicae. They include the muscularis mucosae and remain covered by the investing layer of longitudinal muscle. The majority occur at weak points in the circular muscular layer where the main blood vessels penetrate. They are usually confined to the sigmoid, but sometimes spread from there to more proximal locations. The rectum is never involved. Diverticulosis of the right colon only is a separate condition with a high incidence in Hawaii, and may have a different etiology. Isolated diverticula of the right colon are also unrelated to the common forms of the disease, and may be congenital or due to pulsion from high intraluminal pressures. The most consistant feature of diverticular disease of the sigmoid is the muscular abnormality resulting in thick, cartilagenous-like taeniae coli, and corrugated or concertina-like circular muscle. Often the lumen of the bowel is filled with redundant folds of mucous membrane, possibly due to muscular action or pericolic fibrosis. Histologically, the muscle shows thickening, but no hyperplasia or hypertrophy of the muscle cells. Diverticulitis usually begins at the apex of the diverticulum and commonly involves the pericolic and mesenteric fat. Inflammation usually results from abrasion of the mucosa by a fecolith, and rarely occurs in over three or four diverticula in a patient. Pericolic abscesses of diverticulitis are composed of pus and necrotic tissue, are usually chronic in character, and become walled off by fibrous tissue. Crohn's disease may coexist with diverticular disease, and results in an accompanying proctitis or anal lesion. Pathologically, the mucous membrane will be granular or ulcerated, rather than normal as in uncomplicated diverticular disease. Granulomas may be confused with foreign body giant cell reaction to fecal material in pericolic abscesses. Ulcerative colitis, polyps and cancer may also coexist with diverticular disease and should be watched for. Evidence suggests that diverticular disease is due to abnormal increase in the tone of the longitudinal muscle, particularly the taenia coli, which shorten the bowel. Diverticula probably form by pulsion at the weakest point in the wall.

7402 THE TREATMENT AND POSTOPERATIVE COMPLICATIONS OF CONGENITAL MEGACOLON: A 25 YEAR FOLLOWUP. *(Eng.)* Swenson, O.; Sherman, J. O.; Fisher, J. H.; Cohen, E. (Miami Univ. Sch. Medicine, Miami, Fla.). *Ann. Surg.* 182(3):266-273, 1975.

The postoperative complications and long-term follow-up in 483 patients treated by abdominoperineal resection for congenital megacolon are reported. Thirteen pediatric surgeons were contributors to this series. The surgery was performed in a single stage with no preoperative or postoperative ileostomy or colostomy, in two stages with a preoperative ileostomy or colostomy and a takedown of the ostomy at the time of resection, or in three stages, involving a preoperative ostomy, resection, and closure of the ostomy. The patient ages ranged from less than 1 mo to 50 yr, with a mean age of 4.9 yr. There were 16 postoperative deaths (3.3%) and six late deaths (1.2%) from enterocolitis. Immediate postoperative complications included: positive urine cultures in 7.7% of the patients, a wound infection rate of 4.6% (primarily attributable to wound contamination from a preoperative colostomy or ileostomy), dehiscence of the wound in six patients, leak of the coloperineal anastomosis in 24 patients, positive blood cultures in 14 patients, 14 pelvic abscesses, eight intra-abdominal abscesses, and postoperative bowel obstruction requiring laparotomy in 13 cases. Anastomotic leak was unrelated to age at resection or presence of colostomy or ileostomy, but it was significantly increased in patients with Down's syndrome and was most frequent in patients with aganglionosis limited to the rectum. Anastomotic leak significantly increased the incidence of other serious complications. Late postoperative complications included rectal stricture in 30 patients, only seven of whom required a second operation, temporary late soiling in 54 patients, and permanent soiling in 10 patients. Late soiling was significantly more frequent in patients with aganglionosis limited to the rectum than in patients with any other length of aganglionic bowel. There were no patient claims of urinary incontinence or impotence. The low incidence of postoperative complications and the minimal frequency of long-term complications indicate that the abdominoperineal resection is a safe, effective method for the treatment of congenital megacolon.

7403 MELANOSIS COLI: STUDIES OF THE TOXIC EFFECTS OF IRRITANT PURGATIVES. *(E.)* Steer, H. W.; Colin-Jones, D. G. (Southampton Univ. Medical Sch., England). *J. Pathol.* 115(4):199-206, 1975.

The toxic effects of irritant purgatives were investigated ultrastructurally and histochemically in colonic biopsies from six patients with normal colon and seven patients with melanosis coli. Sections of biopsy tissue were subjected to one of several staining procedures for identification of cytoplasmic organelles. Anthraquinone purgatives increased the number of macrophages in connective tissue of the colonic mucosa. Macrophages near the luminal surface showed more intense acid phosphatase and nonspecific esterase activity than those further away, but no β-glucuronidase activity. Most of the pigment was in the macrophages with less intense acid phosphatase activity; the pigment was positive to Nile blue sulfate method and Schmorl's method indicating the presence of lipofuscin. The purgative also caused an increase in the number of lysosomes in macrophages, Schwann cells, and neurones of the submucosal plexes of the colonic mucosa. An association between lipofuscin and lysosomal particles was confirmed by the finding of acid hydrolases and lipofuscin in macrophages, ganglion cells, and Schwann cells. It is concluded that the effect of anthraquinone cathartics in producing pigmentation is the result of a common cytological response, involving the lysosomes, by different tissues. The pathological effects of these drugs result from their influence on lysosomes in macrophages and nervous tissue.

7404 SURGICAL TREATMENT OF HEREDITARY ADENOMATOSIS OF THE COLON AND RECTUM IN SWEDEN DURING THE LAST 20 YEARS. PART I. INTRODUCTION. SURGICAL PROCEDURES USED. PRE- AND POSTOPERATIVE MEASURES. ARRANGEMENT OF FOLLOW-UP. PROPOSITI GROUP, PRIMARY AND LATE RESULTS. *(E.)* Alm, T. (St. Erik's Hosp., Stockholm, Sweden). *Acta Chir. Scand.* 141(3): 218-227, 1975.

The prevalence of hereditary adenomatosis of the colon and rectum was surveyed in Sweden since 1959. Up to the end of 1972, 97 families were traced and 80 of them were more fully investigated. In 56 of the latter families there were at least two affected members; in the other 24, only one. In all, 340 affected individuals were found, 150 of whom were operated on with the aim of cure. Of these, 82 had presented with symptoms (the propositi group), while 68 affected individuals were detected during the family investigations and underwent prophylactic operations (the call-up group). A comparison was made between the two groups of the primary and long-term results after surgery. Major surgery with total protocolectomy and ileostomy or colectomy with ileorectal anastomosis was performed in 67 propositi and 68 call-up patients; minor surgery with segmental resection was performed in 15 propositi. In the propositi group there were three surgical deaths. At the time of operation 48 patients had already developed cancer. Up to the end of the observation period, 16 had died from metastases, two of other malignancies, and three of nonmalignant disease. In the call-up group, there were three surgical deaths and two late deaths from metastases and other malignancy.

7405 SURGICAL TREATMENT OF HEREDITARY ADENOMATOSIS OF THE COLON AND RECTUM IN SWEDEN DURING THE LAST 20 YEARS. PART II. PATIENTS WITH PROPHYLACTIC OPERATIONS, PRIMARY AND LATE RESULTS. DISCUSSION AND SUMMARY. *(E.)* Alm, T. (St. Erik's Hosp., Stockholm, Sweden). *Acta Chir. Scand.* 141(3):228-237, 1975.

The surgical treatment of patients with hereditary adenomatosis of the colon and rectum is described as part of an investigation, started in 1959, of Swedish families. There were 68 affected, but symptom-free, individuals detected and referred for surgical treatment. Total proctocolectomy and ileostomy were performed in ten cases, colectomy with ileorectal anastomosis in 58. The surgical mortality was 4.4%. Six patients had cancer at the time of operation, and two other patients were operated on for colonic cancer many years prior to the diagnosis of adenomatosis of the colon and rectum. One of those eight pa-

tients died from metastases. Primary malignant kidney tumor was responsible for the only additional late death in this group. In another group of patients operated on because of symptoms, cancer was found in 48 patients, 16 of whom died from metastases. Families in which the disease runs should be placed under continuous supervision. To make this practicable on a large scale, a well functioning central register is necessary. Children of an affected parent should be called for examination at regular intervals over an indefinite period, or at least up to the age of 40. Whenever the disease is diagnosed, the patient should be referred to surgery as soon as is convenient. In the vast majority of cases ileorectal anastomosis is the operative procedure of choice.

7406 IMMUNOTHERAPY OF EXPERIMENTAL COLON CANCER: IMMUNOLOGIC ENHANCEMENT OF GRAFTED TUMOR. *(Fr.)* Martin, M. S.; Martin, F.; Lagneau, A.; Horiot, J. C.; Chomono, R. (Laboratoire de Medecine Experimentale et d'Immunologie, et centre G. F. Leclerc, Faculte de Medecine, boulevard Jeanne d'Arc, F 21033 Dijon, France). *Biol. Gastroenterol. (Paris)* 7(4): 249-252, 1974.

Two techniques of immunization were used in this study of 42 BD-IX strain rats (21 test animals and 21 controls). Immunization was induced by six s.c. grafts of a DHB line syngeneic colon carcinoma sterilized by irradiation. The control animals underwent a "test" operation to standardize surgical procedures. Immunization was continued by two injections of $10^6$ live cells obtained from trypsinization of DHB treated by mitomycin and neuraminidase. Mitomycin is a radiomimetic agent which blocks cellular multiplication and neuraminidase probably unveils immunological sites masked by sialic acid. Three weeks after the last "immunizing" injection, all the remaining animals (18 immunized, 17 controls) were injected s.c. with $10^6$ viable untreated cells. The tumor grew in all immunized animals and in ten of 17 control animals, the tumor weighing 3,104 mg and 412 mg, resp. The results indicate reverse immunoprotection of unknown mechanism which leads to enhancement of the tumor. It has been suggested that the cause may be a preponderance of the tumor response (antibody) over the cellular one (lymphocytes). The results call attention to the potential hazards of immunotherapy in human colonic cancer.

7407 SIMULTANEOUS OCCURRENCE OF MULTIPLE GASTRIC CARCINOMAS AND FAMILIAL POLYPOSIS OF OF THE COLON. *(E.)* Ohsato, K.; Watanabe, H.; Itoh, H.; Yao, T.; Nishimura, M. (Kyushu Univ. Faculty Medicine, Fukuoka 812, Japan). *Jpn. J. Surg.* 4(3): 165-174, 1975.

The simultaneous occurrence of multiple gastric carcinomas and familial polyposis of the colon is reported in ten cases. Heredity was confirmed in nine of the ten cases. In eight of the ten cases subjected to detailed study of the upper gastrointestinal tract, polyps and/or carcinomas were detected in the stomach and/or duodenum. Gastric and/or duodenal polyps were found in seven, including one case with concomitant presence of multiple gastric carcinomas. In one case, only carcinomas in the stomach were detected. Histological studies on these polyps revealed all were adenomas except for one case of hamartomatous polyposis. Polyps were not found in small intestine on x-ray examination. All cases except one were treated surgically with single or multiple stage procedures. Total colectomy with or without resection of the rectum was followed by ileorectal anastomosis in six and permanent ileostomy in three. New polyps arising in the preserved rectum after ileoproctostomy were fulgurated or extirpated. There was no surgical death. The presence of numerous adenomas was confirmed in resected and autopsy specimens of the colon and rectum. Adenocarcinomas were present in nine of the ten cases. The rather frequent association of gastroduodenal polyps and cancerous lesions in familial polyposis suggests that such association is a part of the manifestation of this inherited disease. The association indicates that the potential for malignancy occurs not only in the large intestine but in the gastroduodenal mucosa.

7408 CANCER OF THE COLON: SOCIOECONOMIC VARIABLES IN A COMMUNITY. *(E.)* Lynch, H. T.; Guirgis, H.; Lynch, J.; Brodkey, F. D.; Magee, H. (Creighton Univ. Sch. Medicine, Omaha, Nebr. 68178). *Am. J. Epidemiol.* 102(2):119-127, 1975.

The relation between socioeconomic factors and the incidence of cancer of the colon was studied in Omaha-Douglas County, Nebraska, (population 345,000) in 1964. Sources of data were medical records from all of the community hospitals and pathology departments, physicians' records and patient interviews. A total of 154 cases of colon cancer were identified in the county in question in 1964 (incidence rate of 44.7/100,000 of population). The median age of the colon cancer probands was 67.2 yr and no significant sex differences were identified. No specific association was observed with any specific occupation and the reported smoking habits did not vary significantly from expectations in this population. Of the 154 cases, 9.7% had one or more first degree relatives with colon cancer and 45.8% had one or more first degree relatives with a history of cancer of any anatomic site. There was a greater frequency of colon cancer in patients living in census tracts with higher average income than in those with lower average income. The opposite was true of esophageal cancer; no familial occurrences of this disease were observed. There was a slight preponderance of affected blacks. Although the survival rate with colon cancer was consistently lower in the lowest socioeconomic group than in the highest socioeconomic group, the difference was minimal. Cancer control implications suggest that screening for colon cancer should be most rigorous among the highest socioeconomic groups.

7409 CARCINOMA OF THE RIGHT COLON. *(E.)* Sawhney, K. K.; Kambouris, A. A. (V. A. Hosp., Detroit, Mich.). *Am. Surg.* 41(6):364-369, 1975.

Records of 93 patients with carcinoma of the cecum, appendix, ascending colon, and hepatic flexure were

reviewed with respect to primary characteristics and treatment results. The patients ranged in age from 27 to 92; 62.4% were female and 37.6% male. The most frequent symptoms were abdominal pain, weight loss, and weakness. Nausea and vomiting, blood in the stool, and diarrhea were also common. A mass in the right lower quadrant was present in 46%. Intestinal obstruction was present in 12, 75% of which had the tumor in the cecum. Barium enema was performed in 90% and was diagnostic in all but one case. In 50% of the patients, hemoglobin was under 10 g% and in 80% it was under 12.5 g%. Occult blood was in the stools of 50% of 40 patients tested. In 15 cases the tumor was grossly limited within the colonic coats, in 26 it extended to the pericolic fat, in 29 there were metastases to the regional lymph nodes, and in 18 there were metastases to other intraabdominal organs, notably the liver. A right hemicolectomy was performed in 81 (87%). In three the tumor was not resectable and an ileotransverse colostomy was performed. Of four patients with carcinoma of the appendix, three had appendectomy only, and one a delayed right colectomy. In five inoperable patients, chemotherapy was given in four and radiotherapy in one. There were altogether 49 lesions in the cecum, four in the appendix, 41 in the ascending colon, and four in the hepatic flexure. Five patients had multiple lesions, 22 had associated adenomatous polyps, and five had previous intestinal carcinoma. Of the 88 patients given surgery, 13 (14.7%) died within one month: four from peritoneal sepsis, seven from cardiopulmonary causes, one from hypoglycemic shock, and one from cerebral thrombosis. Eighteen patients developed postoperative ileus, 13 wound infections, 4 wound dehiscence, 6 fecal fistulas, and 12 postoperative obstruction. Twelve developed cardiorespiratory complications. Of the 81 right hemicolectomies performed, 64 (79%) were curative, and 17 (21%) palliative. Of the 88 patients operated upon, 40 died during a 5-10 yr follow-up. Of 27 who died during this period, 50% died within 12 months. Overall mortality was 14.7%. Absolute 5-yr survival was 32.2% among all 93 patients. No conclusions are drawn.

7410 ACUTE COMPLICATIONS OF COLO-RECTAL CANCER: SITE, STAGE AND SURVIVAL. *(E.)* Fielding, L. P.; Wells, B. W.; Payne, P. M. (St. Mary's Hosp., London, W.2 England). *Clin. Oncol.* 1(2):121-126, 1975.

A series of patients with colorectal cancer was examined to determine whether this disease has a favorable prognosis, and whether patients who present for admission with an emergency differ in terms of age, tumor site, and degree of spread of tumor from those who present for elective treatment. Of 388 patients studied, 155 presented with an emergency. Large intestinal obstruction was the presenting feature in 90; peritonitis was present in 28; diarrhea, abdominal pain and rectal bleeding were seen in 16; and the remaining 21 presented with other emergencies. Only two of 59 patients who did not undergo surgery survived more than 1 yr, and all died by 2 yr. Laparotomy with or without a drainage procedure was carried out in 82 patients: 19 survived 1 yr and seven survived 2 yr. If distant metastases were present at the time of surgery (99 cases) the chances of survival for 1 yr were one in three, and only three patients survived longer than 3 yr. Patients who were emergency admissions and had their tumors resected had a significantly shorted survival time after 3 yr than those receiving elective resection ($P < 0.02$). There was no difference between the groups in the incidence of lymph node or hepatic involvement. The proportion of Dukes' B tumors in the emergency group was greater than that in the elective group (39 and 29%, resp.). The difference in resection rates between the groups was large: 44 and 72% for the emergency and elective groups, resp. The poorer survival figures in the emergency group may partly result from the greater extent of spread of the primary tumor or possibly from the delay associated with a staged resection.

7411 EPIDERMOID CYSTS, POLYPOSIS COLI AND GARDNER'S SYNDROME. *(E.)* Leppard, B.; Bussey, H. J. R. (St. John's Hosp. for Diseases of the Skin, London, WC2H, 7BJ, England). *Br. J. Surg.* 62(5):387-393, 1975.

The nature, incidence, and mode of inheritance of the skin cysts of Gardner's syndrome were investigated in 196 members of 15 families with Gardner's syndrome as part of a large survey of benign familial skin tumors. Sixty patients were interviewed either at the hospital or at home. Information from hospital notes was available on 82 patients, 25 replied to letters, and information on 29 was obtained from other members of their families. Cysts of the skin were found in 39 of the 74 patients with polyposis. Microscopical examination of 24 cysts from 15 patients all showed the characteristic features of epidermoid cysts. No examples of pilar cysts or steatocystoma multiplex were found. The number of cysts/patient varied from one to 20, the average was four. In only one patient were they large and disfiguring. The age of onset of the cysts was from birth to 35 yr, with an average of 13 yr. Based on four pedigrees studied, it is concluded that polyposis coli is inherited as an autosomal dominant trait. At present it is not possible to say if Gardner's syndrome is the same as, or different from, familial polyposis. Until all patients with colonic polyps have a full clinical examination for surface tumors, x-rays of the skull and long bones to detect osteomas, and dental x-rays for abnormalities of the teeth, this question will remain unanswered.

7412 EFFECTS OF TWO TYPES OF DIETARY FIBRE IN FAECAL STEROID AND LIPID EXCRETION. *(E.)* Walters, R. L.; Baird, I. M.; Davies, P. S.; Hill, M. J.; Southgate, D. A. T.; Green, J.; Morgan, B. (West Middlesex Hosp., Isleworth, Middlesex, England). *Br. Med. J.* 2(5970):536-538, 1975.

The effects of sugar cane residue and wheat bran on stool weight and fecal excretion of acid, neutral steroids and lipids were studied, as well as the effects of sugar cane residue on plasma cholesterol and triglyceride levels, gastrointestinal transit and fecal bacterial flora. Of 19 healthy women in the sugar cane residue group, nine were given a

supplement of 10.5 g of the residue in biscuit form and the other ten were given control biscuits low in fiber. Another five subjects were given a supplement of 39 g of wheat bran. The addition of sugar cane residue increased the total dietary fiber by almost 9 g/day in the first group. Stool dry weight in this group was increased by 50% and wet weight by almost 60%. There was an increased daily loss of acid steroids and fatty acids. Elevated excretion of bile and fatty acids did not cause any lowering of plasma cholesterol or triglyceride levels. Gastrointestinal transit time was significantly reduced and there were physicochemical changes in the feces, but the composition of the fecal flora did not change. The average control level of dietary fiber (14 g) was increased to 27 g by the bran supplement. Dilutional effects were observed for both acid and neutral steroids. It is suggested that the different effects of sugar cane residue and wheat bran on steroid excretion are due to differences in their chemical composition.

7413 COLONIC ELECTROLYTE TRANSPORT IN HEALTH AND IN CONGENITAL CHLORIDE DIARRHEA. *(E.)* Holmberg, C.; Perheentupa, J.; Launiala, K. (Children's Hosp., Univ. Helsinki, Helsinki, Finland, SF 00290). *J. Clin. Invest.* 56(2):302-310, 1975.

The colonic defect in congenital chloride diarrhea was studied, in addition to normal transport, in three patients with the defect and in their three healthy siblings. Colonic perfusions with $^{36}Cl^-$ were performed. In eight perfusions of the controls, the mean flow of the ileal effluent was 0.9 ml/min and the mean concentrations were: $Na^+$, 108.3; $K^+$, 8.8; $Cl^-$, 67.9; and $HCO_3^-$, 25.3 mEq/l. In 12 perfusions of the patients, the mean rate was 1.8 ml/min and the mean concentrations were: $Na^+$, 100.0 mEq/l; $K^+$, 7.3 mEq/l; $Cl^-$, 118.0 mEq/l; $HCO_3^+$, 3.4 mEq/l. There was a marked reduction of $Cl^-$ transport in patients compared to controls. With an extracellular fluid-like perfusate, there was almost no movement of $Cl^-$. Both influx and efflux were minimal. Reduction of $Cl^-$ concentration in the perfusate caused net secretion of $Cl^-$. In contrast to controls, absence of $HCO_3^-$ did not alter the $Cl^-$ movement. Absorption of $Na^+$ was impaired when the luminal contents were acid; net $K^+$ secretion was increased. These data suggest a defect in the carrier-mediated $Cl^-/HCO_3^-$ exchange mechanism as responsible for the transport impairment in congenital chloride diarrhea.

7414 DISODIUM CROMOGLYCATE IN THE TREATMENT OF CHRONIC PROCTITIS. *(E.)* Heatley, R. V.; Calcraft, B. J.; Rhodes, J.; Owen, E.; Evans, B. K. (Univ. Hosp. Wales, Cardiff, Wales). *Gut* 16(7): 559-563, 1975.

A randomized, double-blind, crossover trial was conducted to examine the effect of disodium cromoglycate (DSCG) on chronic proctitis. Twenty-six patients (mean age of 39 years) with chronic proctitis were studied. All active symptoms were present, including: rectal bleeding, mucus passage, decreased frequency of bowel movement and abnormal rectal mucosa on sigmoidoscopy. One hundred mg of DSCG was given p.o. three times/day and 200 mg was self-administered by enema for a period of 4 wk. The three measures of clinical response were: change in sigmoidoscopy, change in bowel frequency and change in blood loss. There was no significant change in the hemoglobin, WBC, ESR or serum IgE levels during the treatment. Patients who responded to DSCG (14 of 26) had significantly more eosinophils in their rectal biopsies than nonrespondents. There was poor correlation between the mucosal inflammatory reaction and changes in the clinical response and sigmoidoscopic appearance. This study provides evidence suggesting that immune mechanisms are important in the pathogenesis of some cases of proctitis and DSCG may play a role in routine patient management.

7415 THE RESPONSE OF THE DOG COLON MUCOSA ONE HOUR'S ISCHAEMIA. *(E.)* Robinson, J. W. L.; Menge, H.; Mirkovitch, V. (Hopital Cantonal Universitaire, CH-1011 Lausanne, Suisse). *Res. Exp. Med. (Berl.)* 165(2):127-134, 1975.

The morphology and function of segments of dog colon were studied immediately after or 24 hr after brief ischemia (one hr). Functional analysis of the mucosa consisted of both transport and metabolic studies and included the determination of net sodium transport across the mucosa *in vitro*, the transport capacity *in vitro* for sugars and amino acids, tissue respiration, lactate production and the liberation of acid phosphatase. Immediately after the ischemia, all parameters differed significantly from the control mucosa: net sodium transport was abolished; amino acid and sugar uptake, oxygen consumption and lactate production were reduced; and lysosomal enzyme release was increased. All parameters, except sugar uptake, had normalized 24 hr after the trauma. Histological examinations revealed such variation in the lesions occurring after the ischemia, varying from slight epithelial desquamation to considerable mucosal destruction. In most cases, the mucosa had almost normalized 24 hr later. Morphometric analysis revealed decreased mean mucosal thickness immediately after the trauma, though 24 hr later there was again no significant difference with the control group. The results demonstrate that the colon, like the small intestine, loses most of its functional properties immediately after brief ischemia, but it is able to recover most of its functional integrity within 24 hr of the insult. The extent of the morphological damage of the colon immediately after the ischemia is much more discrete than that occurring in the ileum. This finding indicates that, despite the apparent identity of the functional results, both the sensitivity of the colon to ischemia and its regenerative capacity are less extreme than those of the small intestine.

7416 BACTERIAL STUDIES OF CLINDAMYCIN-ASSOCIATED COLITIS: A PRELIMINARY REPORT. *(E.)* Marr, J. J.; Sans, M. D.; Tedesco, F. J. (Washington Univ. Sch. Medicine, St. Louis, Mo. 63110). *Gastroenterology* 69(2):352-358, 1975.

The proctoscopical and bacteriological features of clindamycin-associated colitis were correlated. All patients (16) were taking clindamycin; none were on any other antibiotic. All patients developed diarrhea and underwent proctoscopy; during the procedure fecal specimens were taken and cultured. Biopsies were also taken. In five patients with diarrhea, but not pseudomembranous colitis, fecal cultures showed a variety of anaerobic organisms approximating that in normal intestinal flora. In six patients with pseudomembranous colitis, there was a striking decrease or absence of anaerobic organisms (one anaerobe in three patients and in the other three, no anaerobes). Most had facultative flora, including *Escherichia coli, Klebsiella-enterobacter* sp., *Proteus* sp. and enterococci. Five patients with resolving colitis (2-3 weeks after biopsy-proven pseudomembranous colitis had subsided) showed normal numbers of anaerobes. There seemed to be fewer species, but this was not conclusive. All three groups appeared to have the same population of facultative organisms. It is concluded that the disappearance of pseudomembranous colitis is associated with regrowth of anaerobic flora.

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Two cases of cytomegalic inclusion virus (CMV) infection of the bowel are presented. A white female with a history of Crohn's disease presented with severe attacks of pain and diarrhea. Barium studies disclosed multiple colox-colic fistulae, which responded to conservative therapy. After six yr she presented with pyrexia, dysentery, weight loss, and painful ulcers of the tongue, mouth, and conjunctivae. A variety of antibiotics, azathioprine (100 mg/day for 2 weeks), and prednisone (80 mg/day for 11 days) failed to help. Laparotomy revealed the entire colon to be thickened with dense adhesions between loops of colon and adjacent ileum. The ileum also appeared abnormal and inflammed. Postoperatively, the patient developed bilateral bronchopneumonia and died. Histologically, the colon showed extensive ulceration with an inflammatory cell infiltrate of lymphocytes, histiocytes, and plasma cells. Throughout the involved areas of the colon were enlarged cells containing eosinophilic intranuclear inclusions surrounded by halos, and extensive bacterial bronchopneumonia. The second case was a black male who presented with watery, offensive stools, vomiting and loss of appetite, weight loss, swelling of the legs and abdomen, and abdominal pain with audible borborygmi. Laparotomy revealed ascites, and the entire length of the bowel was edematous. The terminal 50 cm of the ileum was grossly thickened. This portion was resected, but the patient died postoperatively of bilateral bronchopneumonia. The resected section of ileum showed a cobblestone appearance with pseudopolypi and minute areas of ulceration. The mucosa had heavy infiltration of histiocytes. Large cells with intranuclear inclusions were present in relation to the ulcerated areas and to the capillaries. The first case appears to be Crohn's disease in which CMV was an opportunistic invader. The second case showed a histology unlike tuberculosis, lymphoma, or Crohn's disease, and may represent primary bowel disease caused by CMV. It is concluded that clinicians should be aware of the possibility of CMV disease in patients debilitated by illness and cytotoxic therapy; that preexisting pathology may be modified by CMV invasion; and that diagnosis must be made by culture, or colonic or rectal biopsy.

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## LARGE INTESTINE

### Ulcerative Colitis

7495 PSYCHOSOMATIC STUDY OF PATIENTS WITH TOTAL COLECTOMY FOR ULCERATIVE COLITIS. *(Fr.)* Hachette, J. C.; Bonfils, S.; Boutelier, P. (Service de Gastro-enterologie B et de Chirurgie Hopital Bichat, 170, Blvd. Ney, F. 75877 Paris Cedex 18). *Arch. Fr. Mal. App. Dig.* 63(7):573-580, 1974.

A psychosomatic study of 30 patients after total colectomy for ulcerative colitis was carried out; 17 of them had an ileo-rectal anastomosis (IRA) and 13 others had a definitive ileostomy (I) with proctectomy. The psychosomatic examination was different for each patient in length, timing, and nondirectiveness. Postoperatively, the patients were asked to evaluate: 1) their preoperative understanding of the nature and importance of the surgical intervention (it was clear to the patient 50% of the time), 2) their mood (40% proved nervous), and 3) the quality of the information they received (in retrospect, an IRA patient was always judged to be better informed than an I patient). The postoperative evaluations were that: 1) the psychological state of the patient was very much a function of the frequency of bowel movment (BM) for the I patient, 2) a surprising number of patients reported absolutely no change in their sex life (70%) as a consequence of the surgery (no case of impotence was mentioned), 3) patients with IRA and infrequent BM maintained their prior activities. Ilectomy was accepted less well than IRA, the former being regarded as a mutilation with unconscious reference to castration, but no psychosis ever developed. Nevertheless, such a surgical incervention required not only a psychological and medical preparation of the patient but also adequate acceptance and understanding on the part of the family. These data are not solely to be interpreted as a function of surgical intervention; one must take into account the preexisting psychological make-up of the ulcerative colitis patient.

7496 TISSUE CULTURE OF THE SERA IN HUMAN ULCERATIVE COLITIS. *(E.)* Hardin, C. A.; Werder, A. A. (Univ. Kansas Medical Center, Rainbow Blvd. at 39th, Kansas City, Kans. 66103). *Am. J. Surg.* 130(7): 20-22, 1975.

The effects of inoculation of serum (0.1 cc) from either control patients, postcolectomy patients, or those with ulcerative colitis on the growth of human amnion cell cultures were investigated. The sera from 11 control patients had no effect on human amnion cell cultures. Sera from 19 of 21 patients with ulcerative colitis showed a marked cytopathic effect

with cell destruction. Three of these sera exhibited a cytopathic effect that was passable on three additional inoculations of human amnion cell cultures. The remaining two sera, both from patients with ulcerative colitis in an inactive state, had no effect. Sera of six patients with ulcerative colitis studied one yr or longer after total colectomy and proctectomy for the disease had no cytopathic effect on human amnion cell culture. Rabbits inoculated i.p. (2.0 cc) with these human sera did not develop antibodies detectable by the agar diffusion technique, and rabbit antisera did not protect against the cytopathic effect in cell culture studies. The cytopathic effect on cell cultures was not prevented by first heating the sera at 70 C for 30 min.

7497 COLONIC EPITHELIAL CELLS AND POLYMORPHONUCLEAR LEUKOCYTES IN ULCERATIVE COLITIS: AN ELECTRON-MICROSCOPE STUDY. *(E.)* Dobbins, III, W. O. (George Washington Univ. Med. Cent., Washington, D.C.). *Am. J. Dig. Dis.* 20(3):236-252, 1975.

Biopsy specimens from 14 patients with ulcerative colitis were examined to investigate the relation of the polymorphonuclear leukocyte to the colonic epithelial cell. Both light- and electron-microscope studies were made using normal colonic tissue biopsies as control. Observations were confined to the mucosa. Electron micrographs showed apparent intracellular invasion of epithelial cells by polymorphonuclear leucocytes in 10 of 14 patients, almost exclusively in cells at the luminal surface, which appeared to be absorptive-type epithelial cells rather than goblet cells. Polymorphonuclear leukocytes were often seen in luminal contents and ranged from normal in appearance to advanced stages of degranulation; they also frequently packed capillary lumina. Light microscopy showed numerous polymorphonuclear leukocytes within the epithelium, but their intracellular position could be determined only in 1 μm sections processed for electron microscopy. In the control studies, there were two invasions of an epithelial cell by a polymorphonuclear leukocyte, one in a patient with salmonella colitis and one in a patient with Crohn's disease. The results support the concept that the major abnormality in ulcerative colitis resides within the colonic epithelial cell, and that this cell is frequently invaded by polymorphonuclear leukocytes.

7498 THE IN VITRO ACTION OF LYMPHOCYTES ON AUTOLOGOUS COLON EPITHELIAL CELLS IN ULCERATIVE COLITIS. *(E.)* Hunt, P. S.; Trotter, S. (Prince Henry's Hosp., St. Kilda Road, Melbourne, Victoria 3004, Australia). *Aust. N.Z. J. Surg.* 45(2):214-219, 1975.

The action in culture of peripheral blood lymphocytes on autologous large intestinal epithelial cells was studied in 13 patients with severe mucosal ulcerative colitis. Two *in vitro* tests of reactivity between peripheral blood lymphocytes and target large intestinal epithelial cells were performed. The isotope release method was used in all patients and controls. Lymphocytes were added in excess to target cells labeled with $^{51}Cr$. Lymphocyte activity was subsequently measured by the quantity of $^{51}Cr$ released into the supernatant fluid from damaged target cells. The second test of target cell adherence was performed only in patients coming to colectomy and in normal controls. The *in vitro* action of lymphocytes was recorded by their ability to detach live target cells growing as a monolayer in multiple microcultures. Using both methods, the percentage lymphocyte activity was significantly greater in patients with ulcerative colitis when compared with that in normal subjects. Although lymphocyte activity was lower in patients who responded to cortisone than in those eventually treated by colectomy, the difference was not significant. Further control studies showed little lymphocyte activity against autologous skin and ileum, suggesting that autologous lymphocyte-induced damage of large intestinal epithelial cells is a tissue-specific reaction in patients with acute ulcerative colitis. The absence of reactivity in other colonic inflammatory disease also suggests that such increased *in vitro* lymphocyte activity is disease-specific for ulcerative colitis.

7499 HISTOCHEMICAL REACTIONS IN THE WALLS OF THE LARGE INTESTINE IN ULCERATIVE COLITIS. *(E.)* Knapik, Z.; Zarzycki, J.; Osaka, A.; Cader, J.; Goetz, B. (Inst. Internal Diseases, Medical Acad., Wroclaw, Poland). *Mater. Med. Pol.* 7(1):24-28, 1975.

Histochemical reactions for succinate dehydrogenase, tetrazolium nictotinamide adenine dinucleotide (NAD)-reductase, akaline phosphatase, ATPase and glucose-6-phosphate dehydrogenase were studied in the walls (mucosae and muscularis) of the large intestine in 30 patients suffering from ulcerative colitis. Morphologic changes in the intestinal mucosa of the patients consisted of lowered height of the cylindrical epithelium, widening of the crypts of Lieberkuhn, and distinct widening and opening of the goblet cells. There was no significant difference in the distribution of the studied enzymes in the elements of the intestinal wall of healthy subjects and the patients with ulcerative colitis. Weaker reactions for ATPase and alkaline phosphatase in the patients indicated a decrease in active transport across tissue barriers in the large intestine and suggested impaired absorption of water in this organ. Additional confirmation of this concept was provided by the decreased intensity of the reactions for succinic dehydrogenase and tetrazolium NAD-reductase, which are involved in the metabolic activity of mitrochondria and redox processes in them. Redox disorders in the intestinal epithelial cells are linked with decreased production of ATP, which is essential in processes of active transport across cell membranes. The observed changes in intensity of the histochemical reactions in ulcerative colitis play no role in the etiology of the disease but are probably due to the effect on the mucous membrane of the large intestine of factors such as toxins, bacteria and mechanical trauma. It is concluded that the behavior of the histochemical reactions as well as morphologic changes in the walls of the intestines in ulcerative colitis are sufficiently

characteristic to serve in the diagnosis of this disease.

7500 THE SMALL INTESTINAL DISACCHARIDASE ACTIVITY IN ULCERATIVE COLITIS. *(E.)* Gudmand-Hoyer, E.; Binder, V.; Soltoft, J. (Gentofte Univ. Hosp., 2900 Hellerup, Denmark). *Gut* 16(1):209-212, 1975.

Small intestinal disaccharidase activity was examined in 12 patients with ulcerative colitis during the active phase of the disease as well as after complete recovery. Small intestinal biopsies were subjected to stereoscopic as well as histologic examination, and the activity of lactase, sucrase and maltase and alkaline phosphatase was determined. Lactose tolerance tests were carried out in all patients and blood sugar was determined. During the active stage of ulcerative colitis a slightly abnormal intestinal mucosa with wide as well as narrow leaf shaped villi but completely normal crypts and a normal lamina propria was found in six patients. During the inactive stage five patients presented a mucosal picture similar to this. Lactase activity was reduced (median 26 IU/g protein) during the acute stage of the disease but not to values indicating lactose malabsorption. In all but one patient, lactase activity rose significantly (to 42 IU/g protein) during remission. Similarly, sucrase and maltase activities were at their lowest during the acute stage of the disease, but there were no differences in alkaline phosphatase activity. It is suggested that previous studies indicating a high incidence of lactase malabsorption in patients with ulcerative colitis may have included a number of patients of races and ethnic groups in whom the incidence of lactose malabsorption is high.

7501 THE INCIDENCE OF LACTOSE MALABSORPTION IN ULCERATIVE COLITIS. *(E.)* Busk, H. E.; Dahlerup, B.; Lytzen, T.; Binder, V.; Gudmand-Hoyer, E. (Gentofte Univ. Hosp., 2900 Hellerup, Denmark). *Scand. J. Gastroenterol.* 10(3):263-265, 1975.

The incidence of lactose malabsorption in ulcerative colitis was examined in 120 consecutive Danish patients. The diagnosis of lactose malabsorption was based on at least two of the following three criteria: a flat blood glucose curve after ingestion of lactose, but a normal rise in blood glucose after ingestion of glucose and galactose; abdominal discomfort and/or diarrhea after ingestion of lactose; and no or subnormal lactase activity in a jejunal biopsy. Histologically, the jejunal biopsies were normal except for the slight uncharacteristic changes. The prevalence of lactose malabsorption was 9.2%, which was not significantly higher than that in a Danish control group. There was no difference in the distribution according to age and sex, and the incidence was not correlated with the severity of the ulcerative colitis. It is concluded that the high incidence of lactose malabsorption reported in other studies of patients with ulcerative colitis is due to the inclusion of members of racial and ethnic groups in whom lactose malabsorption is a common finding.

7502 IMMUNOGLOBULIN PRODUCTION BY THE RECTAL MUCOSA IN SUBJECTS WITH ULCERATIVE COLITIS. *(E.)* Fiorilli, M.; Luzi, G.; Aiuti, F. (Dept. Medicine III, Univ., Rome, Italy). *Rend. Gastroenterol.* 7(1):1-4, 1975.

The *in vitro* synthesis of immunoglobulins by rectal mucosa removed at surgery from normal subjects and from patients with ulcerative colitis was studied. Among the ulcerative colitis subjects, six had not received previous immunotherapy, five were treated with salazopyrine or immunodepressors (cortisone and azathiopyrine) and one was evaluated before and after therapy. The rectal tissues were incubated at 37 C for 48 hr in medium containing $^{14}$C-L-lysine and $^{14}$C-L-isoleucine. Immunoglobulin production was determined by immunoelectrophoresis and autoradiography. The tissues from the ulcerative colitis patients receiving therapy showed an increased synthesis of IgG and, in four cases, an increase in IgA; IgM production was increased in one case and IgD and IgE were synthesized in one other case. Among the salazopyrine-treated patients, immunoglobulin synthesis was not significantly different from that in the untreated subjects. However, synthesis was greatly decreased in the two cases in which immunodepression therapy was combined with salazopyrine treatment. In the patient treated with immunodepressors alone, IgG synthesis remained elevated above normal values. From the data obtained, no definite conclusions can be drawn regarding therapy in ulcerative colitis.

7503 EARLY COLECTOMY IN SEVERE ULCERATIVE COLITIS. *(E.)* Flatmark, A.; Fretheim, B.; Gjone, E. (Rikshopitalet, Oslo 1, Norway). *Scand. J. Gastroenterol.* 10(4):427-431, 1975.

The treatment of severe attacks of ulcerative colitis over a seven yr period beginning February 1967, using early colectomy in 21 patients with toxic megacolon and 58 patients with fulminating colitis, is described. The preoperative diagnosis of ulcerative colitis was established in all patients by sigmoidoscopy and contrast examination of the large intestine, either by barium enema or a follow through. Macroscopic and histologic examination confirmed the diagnosis of ulcerative colitis in all resected specimens. All patients with toxic megacolon were operated on within 24 hr after admission. Most patients were treated with a two-stage procedure. The acute operation included colectomy, permanent ileostomy, and sigmoidostomy. In these patients the rectum was removed later, usually within three months. Immediate mortality in these 79 patients was 1.2% (one death). Two more patients died in connection with secondary operations. Thus, the overall operative mortality was 3.7%. This compared to a postoperative mortality of 22.2% among 18 patients treated in the preceding seven-yr period. In these patients, there was a prolonged period of medical treatment, including corticosteroid therapy, prior to surgery (generally ileorectal anastomosis). It is concluded that saving the life of the patient, rather than saving the patient from surgery, should have first priority, and this can best be achieved by early colectomy without prednisone treatment.

7504 INIDCATIONS FOR RECTAL PRESERVATION AND ILEO-RECTAL ANASTOMOSIS IN PATIENTS WITH ULCERATIVE COLITIS. *(Fr.)* Mignon, M.; Bonnefond, A.; Vilotte, J.; Soullard, J.; Potet, F.; Lambling, A.; Bonfils, S. (Service de Gastro-enterologie B Hopital Bichat, 170, Blvd. Ney, F 75018 Paris). *Arch. Fr. Mal. App. Dig.* 63(7):541-553, 1974.

A retrospective analysis was run on 48 surgical cases of ulcerative colitis (UC); the patients underwent a total colectomy and a rectal preservation as primary operative procedures. The pre-surgical elements which influence rectal evolution were: the importance of ano-rectal lesions, the intensity of the proctitis, the duration of the sickness, and the existence of a recto-colic cancer. The functional quality of the ileo-rectal anastomosis (IRA) was determined through questioning, clinical and proctological exam and through standard histological study of the rectal mucosa. Of the 48 patients, seven deaths occurred, several of which were linked to conservation of the rectal stump; 17 secondary proctectomies were performed, since frequent rectal hemorrhages occurred. Twenty-eight IRAs were performed, either immediately before or after temporary ileoctomy. For most patients there was little change in socio-professional life or sex life. Contraindications to conservation of the rectum are: peri-anal or peri-rectal suppurations with or without fistulas to the nearby organs, slimming of the ano-rectal diameter, change in the sphincterian apparatus and the existence of cancerous or pre-cancerous lesions.

7505 TOXIC MEGACOLON IN ULCERATIVE COLITIS. *(E.)* Koudahl, G.; Kristensen, M. (Righospitalet, Copenhagen, Denmark). *Scand. J. Gastroenterol.* 10(4):417-421, 1975.

The therapeutic effect of steroid medication in the management of toxic megacolon in 21 of 296 patients with ulcerative colitis was assessed over a 10-yr period. The cases were also analyzed for factors influencing morbidity as well as mortality. The duration of the disease was brief in the majority of the cases, and over half of the patients were over 40 yr. A barium enema, which presumably may provoke dilation of the colon, had been performed in eight cases during the week before the dilatation of the colon was recognized. The ulcerative colitis involved the entire colon in 85%, whereas the dilatation affected predominantly the transverse segment. Fourteen patients were on steroid medication when the dilatation developed. Operation was indicated in 20 patients (colectomy with ileostomy and preserved rectum). Six patients died postoperatively, half of pulmonary complications. Only one death occurred among six patients with perforation of the colon. Postoperative complications occurred in 80%. Both complication rate and mortality were independent of steroid medication. Mortality was lowest among patients treated by a team of internists and surgeons specialized in gastroenterology. This was presumably due to an earlier recognition of the colonic dilatation, intensive medical treatment of severe attacks even before the dilatation had developed, and careful supervision for timing the operation. It is concluded that steroid medication does not improve the results of managing toxic megacolon and that surgery should be performed as soon as corrective measures have been carried out.

7506 SURGICAL CRITERIA IN ULCERATIVE COLITIS. *(Sp.)* Ortega Bevia, J. M. (Facultad de Medicina de Sevilla, Sevilla, Spain). *Hisp. Med.* 32(368):113-114, 117-118, 121-124, 127-128, 131-132, 135, 1975.

7507 NECROTIZING ULCERATIVE COLITIS IN THE NEONATE. *(It.)* Lutati, U. V.; Gavinelli, R. (S. Anna Spec. Prov. Obstet. Gynecol. Hosp., Turin, Italy). *Minerva Pediatr.* 26(37):1869-1871, 1974.

7508 HEMORRHAGING ULCERATIVE RECTOCOLITIS IN CHILDREN. *(Fr.)* Joannard, A.; Bost, M.; Frappat, P. (no affiliation given). *Med. Infant.* 81(5):467-485, 1974.

7509 CARCINOMA OF RECTUM IN ULCERATIVE COLITIS. *(Cz.)* Martinek, K. (Fac. Med., J. Ev. Purkyne Univ., Brno, Czechoslovakia). *Vnitr. Lek.* 20(7):666-669, 1974.

7510 POLICIES AND TECHNIQUES USED IN TOTAL OR SUBTOTAL COLECTOMY TO MAINTAIN CONTINENCE IN PATIENTS WITH ULCERATIVE COLITIS. *(Ger.)* Kuhlmayer, R. (Aus der Chirurgischen Abteilung der Allgemeinen Poliklinik der Stadt Wien, Austria). *Acta Chir. Austriaca* 6(4):86-90, 1974.

7511 CORRELATION OF ENDOSCOPY AND DOUBLE CONTRAST RADIOLOGY IN THE EARLY STAGES IN ULCERATIVE COLITIS AND CROHN'S DISEASE. *(E.)* Laufer, I.; Mullens, J. E.; Hamilton, J. (McMaster Univ. Med. Cent., Hamilton, Ontario, Canada). *Gastroenterology* 68(4):932, 1975.

7512 A CASE OF ULCEROUS COLITIS ASSOCIATED WITH PICA. *(It.)* Di Cagno, L.; Castello, D.; Savio, M. T. (Infantile Neuropsychiatry Sch., Univ. Turin, Turin, Italy). *Min. Ped.* 26(35):1768-1777, 1974.

7513 ULCERATIVE COLITIS, INTESTINAL AMEBIASIS, AND ACQUIRED ICHTHYOSIS. *(Fr.)* Bertrand, J.; Carli-Basset, C.; Jankowski, J. M. (No affiliation given). *Rev. Fr. Gastroenterol.* (108):45-46, 49, 1975.

7514 SKIN LESIONS AS A MANIFESTATION OF ULCERATIVE COLITIS. *(Fr.)* Bertrand, J.; Carli-Basset, C.; Jankowski, J. M. (No affiliation given). *Rev. Fr. Gastroenterol.* (108):37-40, 43, 1975.

7515 ULCERATIVE COLITIS AND ITS COURSE ON X-RAY PLATES. *(Ger.)* Feiereis, H. (Medizinische Hochschule, Lubeck, Germany). *Paediatr. Prax.* 14(4): 235-254, 1974.

7516 INTERCURRENT CYTOMEGALOVIRUS COLITIS IN A PATIENT WITH ULCERATIVE COLITIS. *(E.)* Keren, D. F.; Milligan, F. D.; Strandberg, J. D.; Yardley, J. H. (Johns Hopkins Univ. Sch. Medicine, Baltimore, Md.). *Johns Hopkins Med. J.* 136(4):178-182, 1975.

7517 CLINICAL STUDY OF ULCERATIVE COLITIS. *(E.)* Nath, K.; Saxena, S.; Samuel, K. C. (G.S.V.M. Medical Coll., Kanpur, India). *Indian Practitioner* 27(2):79-85, 1974.

7518 AUTOIMMUNE HAEMOLYTIC ANAEMIA AND ULCERATIVE COLITIS. *(E.)* Gorst, D. W.; Leyland, M. J.; Delamore, I. W. (Royla Infirmary, Manchester, England). *Postgrad. Med. J.* 51(596):409-411, 1975.

See also, 7001, 7297, 7438, 7481, 7492, 7494, 7847, 7914, 7920, 7978, 7981, 7983, 7990, 7991, 7993, 8001.

## PANCREAS

7519 STUDIES ON THE SYNTHESIS OF PLASMA MEMBRANE PROTEINS OF FIBROBLASTS FROM PATIENTS WITH CYSTIC FIBROSIS. *(Eng.)* Changus, J. E.; Quissell, D. O.; Sukup, M. R.; Pitot, H. C. (Univ. Wisconsin Medical Sch., Madison, Wis. 53706). *Am. J. Pathol.* 80(2):317-328, 1975.

The relative radio-incorporation rates or synthetic rates of the plasma membrane proteins were studied *in vitro* to determine if an alteration in plasma membrane function was responsible for secretory abnormalities of sweat and other exocrine glands characteristic of cystic fibrosis (CF) patients. Fibroblasts established from skin biopsies of four patients with CF and four matched normal controls were labeled with $^{14}C$ or $^{3}H$-leucine, during 2 to 36 hr of exposure during active cell proliferation. The plasma membranes were isolated and subjected to analysis in non-detergent acrylamide gel electrophoresis. Coelectrophoresis revealed the absence of a detectable abnormality in the rates of more than 30 resolved protein species. If genetic alteration of a membrane protein exists in CF, it was not apparent from this study.

7520 PANCREATICOCOLIC FISTULA. *(E.)* Carrillo, R. P.; Strauch, G. O. (Stamford Hosp., Stamford, Conn.). *Conn. Med.* 39(9):530-531, 1975.

A case of colonic fistulization secondary to pancreatic abscess, diagnosed prior to operation and successfully treated, is presented. A summary of previously reported pancreaticocolic fistulas (22 cases) in the English literature is presented in a tabular form. The patient, a 48-yr-old woman, presented with a five-month history of abdominal pain, weakness, weight loss of 30 pounds, anorexia, and intermittent nausea and vomiting. The abdomen was distended, and there was a questionable fluctuant mass in the epigastrium. The rest of the physical examination, except for hypertension of 180/105 mm Hg, was within normal limits. She gave no history of alcohol intake or previous biliary tract disease. Chest x-ray, i.v. pyelogram, upper gastrointestinal series, and small intestine series were interpreted as normal. A p.o. cholecystogram revealed non-visualization of the gallbladder. A barium enema revealed extravasation of contrast material from the proximal transverse colon, which appeared otherwise normal. The patient's clinical picture was felt to be most consistent with colonic fistulization from a pancreatic pseudocyst or abscess, as a complication of pancreatitis. On the 10th hospitalization day, the patient underwent laparotomy at which time the entire retroperitoneum was found to be involved in ligneous inflammatory disease. The pancreas was grossly enlarged and indurated with a rubbery consistency. During the mobilization of the ascending and right transverse colon an extensive retroperitoneal abscess, containing foul-smelling grayish exudate, was entered. A large sump drain was placed in the most cephalic portion of the abscess cavity, and large Penrose drains were inserted into the subphrenic space. A Stamm gastrostomy completed the procedure. The patient's postoperative course was uncomplicated. The culture taken at the time of operation yielded *Enterobacter aerogenes*. The patient's nutritional status was maintained with elemental diet feedings through the gastrostomy. She was discharged four weeks after operation. At that time all drains and the gastrostomy tube had been removed; antibiotic therapy had been discontinued. The right colostomy was functioning well, and she was well nourished. The authors believe that a gastrostomy for upper gastrointestinal decompression and for possible later feeding should be considered in this type of case which may require aggressive nutritional support. Elemental diets may greatly benefot patients in such circumstances and are very effectively administered by the gastrostomy route.

7521 THE DIAGNOSIS OF NECROTIZING PANCREATIC LESIONS BY MEANS OF DUODENOSCOPIC PANCREATOGRAPHY. ITS VALUE FOR THE SURGICAL PROCEDURE. *(E.)* Weiss, H. D.; Anacker, H.; Kramann, B.; Scholze, H. (Inst. fur Rontgendiagnostik, Klinikums rechts der Isar, Technischen Univ., Munchen, Germany). *Am. J. Gastroenterol.* 64(1):26-33, 1975.

Duodenoscopic retrograde pancreatography directly demonstrated 14 cases of intrapancreatic abscesses and pseudocysts, replacing more indirect methods (e.g., demonstration of air fluid levels, and observable symptoms) used before 1971. Escape of the contrast medium from the excretory duct system into a cavity allowed for the visualization in 13 of 14

cases of abscess or pseudocyst in the pancreas, retroperitoneum, or the peritoneal cavity. Tryptic lesions were usually found to cause perforation of the involved duct; concomitant deformity was general or limited to the lesion vicinity. Pancreatography allowed differentiation between pancreatic abscess and pseudocyst; abscess borders were better deliniated while cyst wall visualization was often impossible. Differential diagnosis of pancreatic abscess and carcinoma was also possible; necrotic cavities possessed well-defined contours as visualized by penetration of contrast medium whereas carcinomas showed diffuse extraductal opacification. In necrotic lesions, either the ductal system was distorted locally or the whole excretory duct system was involved. In carcinoma, the ductal system usually appeared normal, distal to the tumor. Thus, duodenoscopic pancreatography can be useful for the accurate demonstration of the necrotic lesion, its localization, size determination, and for surgical procedure indications. It must be remembered that it is necessary for surgery to follow immediately duodenoscopic pancreatography in patients with pancreatic abscesses or pseudocysts to avoid bacterial infection or hemorrhagic pancreatitis.

7522 UNUSUAL MANIFESTATIONS OF PANCREATIC PSEUDOCYSTS AND THEIR SURGICAL MANAGEMENT. *(E.)* Christensen, N. M.; Demling, R.; Mathewson, C., Jr. (St. Joseph Hosp., Eureka, Calif. 95501). *Am. J. Surg.* 130(2):199-205, 1975.

Six cases representing selected complications of pancreatic pseudocyst are reported and their surgical management is discussed. Mediastinal presentation of a pancreatic pseudocyst was exhibited in a 61-yr-old man. As with many other patients with the same complication, this patient presented with severe bilateral chest pains with only mild epigastric discomfort. Chronic recurrent pleural effusion rich in protein and amylase, as in this case, represents the disruption of the pancreatic duct with formation of a pancreatic pseudocyst or a pancreaticopleural fistula. Internal drainage from below the diaphragm is the treatment of choice in such patients. Jaundice due to a pancreatic pseudocyst was exhibited in a 41-yr-old alcoholic male. This complication is unusual, and to be certain that obstructive jaundice is directly caused by a pancreatic pseudocyst, operative demonstration of compression of the common bile duct by a pseudocyst, relief of the obstruction by surgical drainage of the cyst, and subsequent disappearance of the jaundice are required criteria. Cysts that cause jaundice are located in the head of the pancreas, and cystoduodenostomy is the treatment of choice. I.p. rupture of a pancreatic pseudocyst occurred in a 48-yr-old white female along with coexisting pancreatic ascites. I.p. rupture has been associated with a high mortality rate, but with adequate fluid replacement, prompt evacuation of the cyst contents from the peritoneal cavity, and adequate drainage, the mortality rate can be reduced. Pancreatic ascites is relatively common and may result from a leaking pancreatic pseudocyst, as in this case. Pancreatic ascites produces elevations in both the serum amylase level and protein concentration. When the cyst is small and is located in the tail of the gland, excision is the definitive treatment, but internal drainage remains the treatment of choice when the cyst is large. Massive hemorrhage from a pancreatic pseudocyst occurred in a 59-yr-old male alcoholic and a 40-yr-old non-alcoholic male. This complication is generally due to the rupture of a small aneurysm developing in a branch of the celiac axis in the wall of the pseudocyst. Prompt arteriography is recommended in any patient with a pancreatic pseudocyst who shows signs of bleeding. Pancreaticobronchial fistula occurred as a complication of a pancreatic pseudocyst in a 29-yr-old woman. Treatment should be directed toward adequate subdiaphragmatic drainage of the cyst.

7523 PANCREATIC CHOLERA. STUDIES ON TUMORAL SECRETIONS AND PATHOPHYSIOLOGY OF DIARRHEA. *(Eng.)* Rambaud, J. C.; Modigliani, R.; Matuchansky, C.; Bloom, S.; Said, S.; Pessayre, D.; Bernier, J. J. (Hôpital Saint Lazare, 107 rue du Faubourg Saint Denis, 75010 Paris Cedex 10, France). *Gastroenterology* 69(1):110-122, 1975.

The results of an analytical investigation of digestive secretions and small intestinal and colonic functions in a 38-yr-old female with pancreatic cholera are presented along with results of characterization and estimation in blood and tumoral extracts of gastrointestinal hormones and other biologically active substances. High concentrations of vasoactive intestinal peptide were present in both systemic blood and tumoral extracts. The plasma levels of calcitonin and prostaglandins E and $F_{\alpha}$ were also increased. Gastric inhibitory peptide and gastrointestinal and pancreatic hormones were absent from the tumor, except for small amounts of glucagon. Their levels in the blood were normal. The basal gastric acid secretion was decreased, but it responded normally to pentagastrin stimulation. Both the basal and secretin-stimulated pancreatic secretions were normal. There was an increased volume of gallbladder bile with high bicarbonate and low bile salt concentrations. However, the electrolyte content and flow rate of fluid passing the duodenojejunal junction were normal. The small intestine was the origin of water and electrolyte fasting losses. The jejunum was the site of bicarbonate secretion. Jejunal glucose and leucine-stimulated water and sodium transports were strikingly decreased. However, the absorption rates of sugar and amino acids were normal. The colon reabsorbed high amounts of water and sodium but increased potassium losses. Most of the patient's upper digestive secretion abnormalities and small intestinal function impairments, as concluded from these data, may have resulted from biological effects of vasoactive intestinal peptide. It is suggested that secondary aldosteronism may explain the modified colonic function.

7524 PANCREATIC PSEUDOCYSTS: REVIEW OF DIAGNOSTICS AND THERAPEUTICS. *(It.)* Benini, P.; Carraro, G. (Ospedale Maggiore Ca Granda, Milan, Italy). *Arch. Ital. Chir.* 98(2):155-185, 1974.

7525 PANCREATIC CYSTS. *(It.)* Varola, F.; Beccaria, A.; Oliaro, A.; Sasso, D.; Villata, E.; Cirillo, R. (Ospedale Maggiore di San Giovanni Battista e della Citta di Torino, Italy). *Minerva Chir.* 30(3):83-125, 1975.

7526 PANCREATIC CARCINOMA ON ENDOSCOPIC RETROGRADE PANCREATICO-CHOLANGIOGRAM. *(Ger.)* Anacker, V. H.; Weiss, H. D.; Kramann, B. (Institut fur Rontgendiagnostik der Technischen Universitat Munchen, Munich, Germany). *Frotschr. Rontgenstr.* 122(3):238-242, 1975.

7527 SURGICAL MANAGEMENT OF PANCREAS CARCINOMA: THE PRESENT POSITION. *(It.)* Doldi, S. B.; Germiniani, R.; Gregoratti, L. (Dep. IIIrd Surg. Pathol., Univ. Milan, Milan, Italy). *Minerva Chir.* 30(102):1-15, 1975.

7528 PANCREATIC REACTION MEASURED BIOLOGICALLY AFTER OPACIFICATION OF THE DUCT OF WIRSUNG BY DUODENOSCOPY. PREVENTIVE EFFECT OF FREY'S INHIBITOR. (67 CASES). *(Fr.)* Leger, L.; Liguory, C.; Bouvresse, M.; Souciet, C. (Hopital Cochin, 27, rue du Faubourg-Saint-Jacques, F 75674 Paris Cedex 14 France). *Nouv. Presse Med.* 4(19):1399-1402, 1975.

7529 REACTIVE DUODENAL CHANGES IN CHRONIC PANCREATITIS SIMULATING CONTIGUOUS SPREAD OF PANCREATIC CARCINOMA. *(E.)* Blackstone, M. O.; Mizuno, H. (Dep. Med., Univ. Chicago, Ill.). *Gastroenterology* 68(4):1020, 1975.

7530 COMPLICATIONS OF ENDOSCOPIC RETROGRADE CHOLANGIOPANCREATOGRAPHY (ERCP): ANALYSIS OF 300 CONSECUTIVE CASES. *(E.)* Zimmon, D. S.; Falkenstein, D. B.; Riccobono, C.; Aaron, B. (Manhattan VA Hosp., New York, N.Y.). *Gastroenterology* 68(4):1017, 1975.

7531 THE PANCREAS: A CORRELATION OF FUNCTION, STRUCTURE AND HISTOPATHOLOGY. *(E.)* Waye, J. D.; Adler, M.; Dreiling, D. A. (Mt. Sinai Sch. Med., New York, N.Y.). *Gastroenterology* 68(4):1010, 1975.

7532 HYPERAMYLASEMIA ASSOCIATED WITH CANCER: DEMONSTRATION OF AN ANOMALOUS ISOAMYLASE COMPONENT. *(E.)* Shimamura, J.; Fridhandler, L.; Berk, J. E. (Coll. Med., Univ. California, Irvine, Calif.). *Gastroenterology* 68(4):986, 1975.

7533 NON-PANCREATIC HYPERAMYLASEMIA IN PANCREATIC CANCER. *(E.)* Shimamura, J.; Berk, J. E.; Fridhandler, L. (Coll. Med., Univ. California, Irvine, Calif.). *Gastroenterology* 68(4):985, 1975.

7534 SPECIFIC DETECTION OF ABNORMALLY HIGH LEVELS OF PANCREATIC ISOAMYLASE IN URINE. *(E.)* Shimamura, J.; Fridhandler, L.; Berk, J. E. (Coll. Med. Univ. California, Irvine, Calif.). *Gastroenterology* 68(4):985, 1975.

7535 PANCREATIC CANCER: A CLINICAL OR TISSUE DIAGNOSIS? *(E.)* Livstone, E. M.; Gudjonsson, B.; Spiro, H. M. (Yale Univ. Sch. Med., New Haven, Conn.). *Gastroenterology* 68(4):937, 1975.

7536 IMPORTANCE OF CELIACOGRAPHY IN THE DIAGNOSIS OF CARCINOMA OF THE PANCREAS. *(Sl.)* Rozhold, J.; Klucar, J. (Inst. Postgraduate Medicine Pharmacy, Bratislava, Czechoslovakia). *Rozhl. Chir.* 54(3):186-190, 1975.

7537 COMPLICATIONS AND REOPERATIONS IN THE SURGICAL TREATMENT OF CANCER IN THE MAJOR DUODENAL PAPILLA. *(Rus.)* Zykov, Iu. A.; Kralish, V. V. (Omsk Medical Inst., USSR). *Khirurgiia (Mosk.)* (1):126-132, 1975.

7538 ANNULAR PANCREAS. *(Ger.)* Stauber, R.; Cesnik, H. (Provincial Hosp., Leoben, Austria). *Acta Chir. Austriaca* 6(2):37-40, 1974.

7539 SURGERY OF PANCREATIC PSEUDOCYSTS: RADICAL OR CONSERVATIVE? CASE CONTRIBUTION. *(It.)* Campana, F. P.; Filippini, A.; Bove, E.; Redler, A. (Istituto di Clinica Chirurgiva III, Univ. Rome, Rome, Italy). *Ann. Ital. Chir.* 47(3-4):331-342, 1975.

7540 HYDROKINETIC AND ECBOLIC PANCREAS FUNCTION OF MAN IN RELATION TO AGE. *(Ger.)* Erb, W. (Zentrum der Inneren Medizin der Universitat Frankfurt/M., Germany). *Fortschr. Med.* 93(12):623-626, 1975.

7541 STUDY OF EXOCRINE PANCREATIC SECRETION FOLLOWING STIMULATION WITH LARGE DOSES OF SECRETIN. ACINAR CELL MASS AND SECRETORY CAPACITY. *(Rus.)* Dreiling, D. A.; Greenstein, A.; Bordalo, O. (Mt. Sinai Medical Coll., New York Univ., New York, N.Y.). *Ter. Arkh.* 47(2):23-32, 1975.

7542 THE EVALUATION OF PATIENTS WITH PANCREATIC DISEASE. *(Ger.)* Gulzow, M. (Bereich Medizin, Universitat, DDR-25 Rostock, Ernst-Heydemann-Strasse, Germany). *Dtsch. Z. Verdau. Stoffwechselkr.* 34(5/6):323-328, 1974.

7543 PANCREATICOGASTROSTOMY: A FURTHER EVALUATION. *(E.)* Mackie, J. A.; Rhoads, J. E.; Park, C. D. (Harrison Dept. Surgical Res., Univ. Pennsylvania, Philadelphia, Pa.). *Ann. Surg.* 181(5):541-545, 1975.

7544 CHANGING PATTERNS IN THE MANAGEMENT OF PANCREATIC PSEUDOCYSTS. *(E.)* Hastings, P. R.; Nance, F. C.; Becker, W. F. (Louisiana State Univ. Sch. Medicine, New Orleans, La.). *Ann. Surg.* 181(5):546-551, 1975.

7545 AN UNUSUAL, DEADLY BLEEDING COMPLICATION IN CONNECTION WITH CHRONIC-RECIDIVE PANCREATITIS. *(E.)* Bodner, E.; Aufschnaiter, M.; Mikuz, G. (Clinic Geriatric Surgery, Univ. Innsbruck, Austria). *Chir. Gastroenterol.* 8(4):322-326, 1974.

7546 CARCINOMA OF THE EXOCRINE PANCREAS: PATHOLOGIC ASPECTS. *(E.)* Kissane, J. M. (Washington Univ. Sch. Medicine, St. Louis, Mo. 63130). *J. Surg. Oncol.* 7(2):167-174, 1975.

See also, 6822, 6988, 6989, 6991, 6993, 6994, 7000, 7012, 7017, 7030, 7037, 7041, 7049, 7050, 7055, 7057, 7058, 7060, 7067, 7170, 7185, 7396, 7573, 7839, 7847, 7848, 7850, 7879, 7961.

## PANCREAS

### Pancreatitis

7547 ENDOSCOPIC PANCREATOGRAPHY IN CHRONIC PANCREATITIS. *(E.)* Liguory, C.; Caletti, G. C.; Fontana, G.; Chavy, A. (St. Antoine Hosp., Paris, France). *Rend. Gastroenterol.* 7(1):27-34, 1975.

The value of endoscopic pancreatography in chronic pancreatitis was studied in 68 cases of clinically and biologically diagnosed chronic pancreatitis and 45 cases in which the clinical, biological, radiological, and radio-isotopic data were contradictory or inconclusive. In 27 of the latter 45 patients, endoscopic pancreatography provided unequivocal evidence to substantiate the diagnosis of chronic pancreatitis. In 60 patients, endoscopic pancreatography showed severe diffuse or segmental morphological changes of the main pancreatic duct; these changes were associated with pseudocyst formation in 15 cases and with stones in the main pancreatic duct in 11 cases. The technique enabled establishment of the exact position, size, and form of the cysts and revealed the stones as a filling defect. Localized ductal alterations of a milder degree were found in 11 cases in the form of strictures or marginal indentations. Parenchymography was achieved in 11 cases, but the findings, together with the other minor alterations, were difficult to interpret. A normal pancreatogram was found in 19 cases, including one patient in whom a diagnosis of chronic pancreatitis had been firmly established. The examination was unsuccessful in 23 patients for anatomical obstacles closely related to the underlying disease. The results indicate that endoscopic pancreatography may be of great value in the diagnosis and evaluation of chronic pancreatitis and in providing evidence of obstructions in the pancreatic flow which might require surgery.

7548 THE PROTEINASES AND PROTEINASE INHIBITORS IN THE PERITONEAL EXUDATE DURING ACUTE PANCREATITIS IN THE RAT. *(E.)* Huttunen, R. (Dept. Surgery, Univ. Oulu, 90220 Oulu 22, Finland). *Ann. Chir. Gynaecol. Fenn.* 64(2):82-87, 1975.

Proteolytic enzymes and protease inhibitors in inflammatory exudate were studied during acute pancreatitis in the rat. Adult male Long-Evans rats were killed 2 and 8 hr after induction of pancreatitis by injection of 0.5 ml of 2% sodium deoxycholate into the pancreatic duct. Protein content was estimated by gel filtration column chromatography. Casein, N-α-benzoyl-DL-arginin-4-nitroanilid hydrochloride (BAPNA) and N-acetyl-L-tyrosine (ATEE) were used as substrates. Two pH optima corresponding to the optimal activities were estimated at pH 6 and 8. The peritoneal exudate showed distinct proteolytic and ATEE hydrolyzing activities; BAPNA was also hydrolyzed to a lesser extent. After 2 hr of pancreatitis, the proteolytic activity at pH 6 was 0.71 and at pH 8, 0.77 μM/min/mg of protein. After 8 hr, these values were 0.87 and 0.90, resp. The ATEE hydrolyzing activity was 0.019 and 0.017 μM/min/mg of protein, resp., for 2- and 8-hr pancreatitis. The trypsin inhibiting capacity was determined as 19.7 and 18.8 μg/mg of protein, resp., for 2- and 8-hr pancreatitis. Gel filtration on Sephadex G-200 showed that the BAPNA hydrolyzing activity was eluted with the macroprotein fraction. The trypsin inhibiting capacity was eluted in two peaks after the macroproteins, but the peak in the pancreatitis group was weak; in controls, the peaks were clearly separated and the trypsin inhibiting capacity was more pronounced. These findings suggest that at least part of the pancreatic enzymes are released into the peritoneal cavity and are associated with inhibitors.

7549 THE HYPOCALCEMIA OF ACUTE PANCREATITIS. *(Eng.)* Weir, G. C.; Lesser, P. B.; Drop, L. J.; Fischer, J. E.; Warshaw, A. L. (Massachusetts General Hosp., Boston, Mass. 02114). *Ann. Intern. Med.* 83(2):185-189, 1975.

The mechanism of hypocalcemia in acute pancreatitis was studied by measuring certain variables involved in calcium homeostasis in 11 patients with pancreatitis. Of these patients, two had common-duct stones, one had hereditary pancreatitis, seven were alcoholics (three of whom presented with hypertriglyceridemia) and one had hypertriglyceridemia with an equivocal history of alcoholism. Total and ionized plasma calcium levels were almost uniformly in the low or low-normal range. Magnesium levels were similar, as were the plasma phosphorus values. Plasma parathyroid hormone was elevated in six patients. Plasma calcitonin was below detection levels in the seven patients so studied. Pancreatic glucagon levels were determined in nine patients and were found to be elevated

in seven and in the upper normal range in the other two. Plasma gastrin was normal in the ten patients in whom it was measured; renal function was normal in all patients. Triglyceride levels were elevated in four. Parathyroid hormone levels were high, and there was a significant inverse correlation with ionized calcium. These data indicate that the hypocalcemia in acute pancreatitis is not the result of abnormalities of secretion of gastrin, glucagon, or parathyroid hormone. The specific mechanism remains unknown, but it is suggested to be extra-skeletal deposition of calcium, an as yet unidentified defect of bone metabolism, or both.

7550 PANCREATITIS ASSOCIATED WITH IDIOPATHIC HYPERLIPIDEMIA: STUDY OF 40 CASES. *(Fr.)* de Gennes, J. L.; Turpin, G.; Turffert, J. (Hosp. de la Pitie, Paris, France). *Ann. Med. Interne (Paris)* 125(4):333-345, 1974.

Different types of hyperlipidemia associated with acute or subacute pancreatitis were studied in 40 cases. There were no cases of pancreatitis associated with hyperlipidemia due to hypercholesterolemia, but pancreatitis was associated with major and massive hyperglyceridemias, type 1, 4 and 5. Pancreatitis was favored or provoked either directly by hyperlipidemia, by excessive lipid input in types 1 and 5, by excessive calorie input in types 4 and 5, indirectly or directly by estrogens during pregnancy and during the use of oral contraceptives in types 1, 4 and 5, and by alcoholism in type 4. It was found possible to avert or alleviate these types of pancreatitis by normalization of the serum lipid levels. Durable, non-familial hyperlipidemia, actually secondary to acute pancreatitis, was never encountered. There is evidence that hyperlipidemia induces pancreatitis rather than the reverse. The primary status of hyperlipidemia is also supported by the clearly demonstrated genetic character of the disease.

7551 SURGICAL INTERVENTION IN THE TREATMENT OF CHRONIC PANCREATITIS. *(It.)* Zanella, E.; Battistini, C.; Farinon, A. M. (Inst. Special Surgery Pathology Clinic Propedeut., Univ. Parma, Parma, Italy). *Ann. Ital. Chir.* 47(3-4):283-302, 1975.

7552 ACUTE ENZYMATIC PANCREATITIS. *(It.)* Belbusti, F. (Ospedale Civile de Urbino, Urbino, Italy). *Clinica* 31(2):121-126, 1975.

7553 COMPLICATIONS IN ACUTE PANCREATITIS. *(Ger.)* Sommer, H.; Kasper, H. (Medical Clinic, Univ. Wurzburg, Wurzburg, Germany). *Med. Klin.* 70(15):645-651, 1975.

7554 ACUTE BILIARY PATHOLOGY AND ACUTE PANCREATITIS. *(Sp.)* Delgado, Dres. B.; Trostchansky, J. (Hospital de Clinicas "Dr. Manuel Quintela," Monterideo, Uruguay). *Cir. Urug.* 45(1): 23-27, 1975.

7555 ACUTE PANCREATITIS IN PREGNANCY AND AFTER DELIVERY. *(Fr.)* Denis, A. (no affiliation given). *Quest Med.* 28(8):465-467, 1975.

7556 THE NATURE OF WATER AND ELECTROLYTE IMBALANCES AND THEIR CORRECTION IN ACUTE PANCREATITIS. *(Rus.)* Shataliuk, B. P.; Makarov, N. A.; Slabkii, P. P.; Kuzniak, V. P. (V. I. Lenin Municipal Hosp., Kamenets-Podolsk, USSR). *Klin. Khir.* (5):60-62, 1975.

7557 FUNCTIONAL VITAMIN A DEFICIENCY IN PATIENTS WITH CHRONIC PANCREATITIS (CP). *(E.)* Toskes, P.; Levy, N. (VA Hosp., Gainesville, Fla.). *Gastroenterology* 68(4):1000, 1975.

7558 THE EFFECT OF ANTICHOLINERGIC AND/OR NASOGASTRIC SUCTION ON THE OUTCOME OF ACUTE ALCOHOLIC PANCREATITIS: A CONTROLLED TRIAL. *(E.)* Switz, D. M.; Vlahcevic, Z. R.; Farrar, J. T. (Med. Coll. Virginia, Richmond, Va.). *Gastroenterology* 68(4):994, 1975.

7559 SIGNIFICANCE OF CARCINOEMBRYONIC ANTIGEN IN PANCREATITIS. *(E.)* Morton, R. E.; Kafka, E. C.; Kalser, M. H. (Univ. Miami, Miami, Fla.). *Gastroenterology* 68(4):961, 1975.

7560 THE PHYSICAL CHEMISTRY OF PANCREATIC CALCIFICATION AND STONE FORMATION: V: LITHOGENICITY AND PANCREATIC "REST" AS A THERAPY FOR PANCREATITIS. *(E.)* Moore, E. W. (Health Sci. Div., Virginia Commonwealth Univ., Richmond, Va.). *Gastroenterology* 68(4):958, 1975.

7561 HYPOTHESIS: HYPOCALCEMIA OF ACUTE PANCREATITIS IS DUE TO RELATIVE HYPOPARATHYROIDISM. *(E.)* Robertson, G. M.; Switz, D. M.; Sizemore, G. W.; Estep, H. L.; Moore, E. W. (Med. Coll. Virginia, Richmond, Va.). *Gastroenterology* 68(4):958, 1975.

7562 STUDIES ON AMYLASE ACTIVITY IN A PATIENT WITH TYPE IV HYPERLIPEMIA AND PANCREATITIS. *(E.)* Mishkin, S.; Bates, J.; Brunton, J.; Lenoff, F.; Schneider, P.; Sniderman, A. (R. Victoria Hosp., Montreal, Quebec, Canada). *Gastroenterology* 68(4): 956, 1975.

7563 ENZYMES AND SECRETION OF THE SMALL INTESTINE MUCOSA IN EXPERIMENTAL ACUTE PANCREATITIS. *(Rus.)* Redchits, P. S. (Odessa Medical Inst., Odessa, USSR). *Patol. Fiziol. Eksp. Ter.* 5(2):74-75, 1975.

7564 CHRONIC CALCIFYING PANCREATITIS. *(Por.)* Sarles, H.; Sahel, J. (No affiliation given). *J. Med. (Oporto, Port.)* 86(1637):751-756, 1975.

7565 A PANEL ON PANCREATIC SURGERY. *(Ger.)* Hollender, L. F.; Kummerle, F.; Longmire, W. P.; Trede, M. (Centre Hospitalier Universitaire, F-Strasbourg 67, France). *Langenbecks Arch. Chir.* 338(2):91-107, 1975.

7566 POSTOPERATIVE PANCREATITIS. *(Rus.)* Toskin, K. D.; Myrkin, S. D. (Crimean Medical Inst., USSR). *Khirurgiia (Mosk.)* (1):122-126, 1975.

7567 TOTAL DUODENOPANCREATECTOMY IN CHRONIC PANCREATITIS WITH ABSCESSES. *(Ger.)* Walzel, D. (Barmherzigen Bruder Hosp., Vienna, Austria). *Acta Chir. Austriaca* 6(3):59-62, 1974.

7568 PANCREATITIS IN PATIENTS WITH CHOLELITHIASIS: VALUE OF ELECTIVE SURGICAL TREATMENT OF KNOWN CHOLELITHIASIS. *(Nor.)* Gerner, T. (Ulleval Hosp., Ulleval, Norway). *Tidsskr. Nor. Laegeforen.* 95(2):104-106, 1975.

7569 CHRONIC PANCREATITIS: EVALUATION OF THE TREATMENT OF STEATORRHEA WITH PANCREATIN. *(Por.)* Mott, C. B.; Barros, M. I. B.; Bettarello, A. (Inst. de Gastroenterologia, S. Paulo, Brazil). *Arq. Gastroenterol.* 12(1):37-40, 1975.

7570 MEDICAL THERAPY IN ACUTE PANCREATITIS. *(Ger.)* Preisich, P. (II. Medizinische Klinik, Semmelweis-Krankenhaus, Budapest, Hungary). *Leber Magen Darm* 5(1):26-29, 1975.

7571 A PROSPECTIVE STUDY OF ACUTE PANCREATITIS. *(E.)* Imrie, C. W.; Whyte, A. S. (Glasgow Royal Infirmary, Glasgow, Scotland). *Br. J. Surg.* 62(6):490-494, 1975.

7572 CLINICAL AND HORMONAL ASPECTS OF PANCREATIC DIABETES. *(E.)* Bank, S.; Marks, I. N.; Vinik, A. I. (Univ. Cape Town, Cape Town, South Africa). *Am. J. Gastroenterol.* 64(1):13-22, 1975.

7573 PREGNANCY AND PANCREATITIS. *(E.)* Dreiling, D. A.; Bordalo, O.; Rosenberg, V.; Rudick, J. (Mount Sinai Sch. Medicine, New York, N.Y.). *Am. J. Gastroenterol.* 64(1):23-25, 1975.

7574 THE ROLE OF LYSOSOMAL HYDROLASES IN THE PATHOGENESIS OF ACUTE PANCREATITIS. *(E.)* Dlugosz, J. (Med. Acad., Bialystok, Poland). *Matern. Med. Pol.* 6(4):260-270, 1974.

See also, 6610, 6808, 6812, 6991, 6994, 7017, 7037, 7041, 4050, 7056, 7330, 7522, 7529, 7530, 7534, 7541, 7542, 7545, 7759, 7898.

## LIVER AND BILIARY TRACT

7575 METABOLISM OF LITHOCHOLATE IN HEALTHY MAN. II. ENTEROHEPATIC CIRCULATION. *(E.)* Cowen, A. E.; Korman, M. G.; Hofmann, A. F.; Cass, O. W.; Coffin, S. B. (Mayo Clinic Foundation, Rochester, Minn. 55901). *Gastroenterology* 69(1):67-76, 1975.

The enterohepatic circulation of lithocholate and its metabolites was studied in four healthy fasted subjects. The intestinal absorption of labeled sulfolithocholylglycine or lithocholylglycine was studied after the intrajejunal instillation of these substances, mixed with the subject's own bile; a triple lumen tube was positioned with its occluding balloon in the third portion of the duodenum. The intestinal absorption of lithocholylglycine or sulfolithocylylglycine relative to cholyltaurine was also studied following the ingestion of a test meal containing these substances, and the metabolism of the steroid and sulfate moieties of sulfolithocholylglycine was studied after the administration of these substances to two subjects under identical conditions. Finally, the lithocholate pool size and input into the total lithocholyl pool were determined using isotope dilution techniques. When mixed with the bile and infused into the jejunum, radiolabeled lithocholylglycine was absorbed more rapidly and more efficiently than sulfolithocholylglycine. When these metabolites were administered in a test meal, 60% of the lithocholylglycine was conserved, but only 20% of the sulfolithocholylglycine was conserved. The daily input of lithocholate into the bile acid pool averaged 100 mg/day, about one third to one-half of the chenodeoxycholic acid synthesis, but the half life was only 0.74 day. The small lithocholate pool (about 100 mg) could be explained by rapid fecal excretion caused by sulfation, which decreases absorption in the jejunum and active absorption in the ileum. There was little desulfation during enterohepatic cycling, but rapid desulfation occurred in the distal intestine, the absorption of $^{35}S$ being followed by urinary excretion. A decreasing $^{35}S:^{3}H$ ratio in the bile indicated that some steroid moiety was conserved to be resulfated. The data indicate that considerable lithocholate is absorbed from the distal intestine in healthy subjects but that efficient sulfation and rapid fecal excretion result in a small total lithocholate pool. A multicompartment model, previously used to describe the metabolism of the steroid and amino acid moieties of the major conjugated biliary acids, was extended to encompass lithocholyl conjugates and their sulfates.

7576 METABOLISM OF LITHOCHOLATE IN HEALTHY MAN. III. PLASMA DISAPPEARANCE OF RADIOACTIVITY AFTER INTRAVENOUS INJECTION OF LABELED LITHOCHOLATE AND ITS DERIVATIVES. *(E.)* Cowen, A. E.; Korman, M. G.; Hofmann, A. F.; Thomas, P. J. (Mayo Clinic Foundation, Rochester, Minn. 55901). *Gastroenterology* 69(1):77-82, 1975.

The plasma disappearance of i.v. radiolabeled lithocholate, lithocholylglycine, and their respective 3-sulfates was defined in four healthy adult male volunteers. The $^{14}C$-labeled (10 μCi) or $^{3}H$-labeled (25 μCi) bile acids were injected into the antecubital veins, and blood samples were obtained from the opposite antecubital vein 2 to 120 min later. Urine was also collected for 24 hr after injection, and bile was aspirated through a double lumen tube for 4 hr after injection. Binding of the bile acids to serum protein was measured by ultrafiltration and the radioactivity in the plasma, urine, and bile was measured by scintillation counting. Lithocholate and lithocholylglycine disappeared rapidly from the plasma, both showing a plasma half-life of less than three min. However, after 15 min, when 99% of the radioactivity had been cleared, the disappearance curve flattened, and chromatography suggested that the chemical form of circulating radioactivity had become sulfolithocholylglycine, the end product of the hepatic metabolism of lithocholate in man. I.v. sulfolithocholate and sulfolithocholylglycine were cleared from the plasma about one-fourth as rapidly as lithocholate and lithocholylglycine. Lithocholate and its derivatives were tightly bound to the serum proteins (87-99%); for a given steroid moiety and mode of conjugation, binding was altered slightly by sulfation, but all sulfated derivatives were also bound tightly (greater than 95%) to the serum protein. The results indicate that sulfation decreases the net flux of lithocholate into the biliary system as well as the extent to which the micelle binds lithocholate derivatives. Further, each bile acid in the plasma has a different input and a different removal rate, and it is the dynamic equilibrium between these that determines the pattern of plasma bile acids during fasting and postprandially.

7577 EFFECT OF AGE ON LIVER FUNCTION. *(E.)* Kampmann, J. P.; Sinding, J.; Moller-Jorgensen, I. (Frederiksberg Hosp., Copenhagen, Denmark). *Geriatrics* 30(8):91-95, 1975.

Age-dependent variations in liver function and in the retention of BSP and iodine 131-labeled rose bengal were studied in 53 subjects aged 50 yr or more. All subjects had minor arteriosclerotic or functional disorders but no liver, kidney, or bone disease. The serum total bilirubin, alkaline phosphatase, and GOT values were determined and the serum proteins were analyzed by paper electrophoresis. Liver biopsy specimens were examined histologically, and the retention of BSP and $^{131}I$-rose bengal was determined following the i.v. injection of these substances. The histological studies confirmed the normalcy of the liver in all but ten subjects; these ten were excluded from the study. The serum bilirubin, alkaline phosphatase, and GOT values were unaltered with increasing age, as was the retention of BSP and $^{131}I$-rose bengal. There were no variations with regard to sex. The median of the 45-min BSP retention test was 4.2%, with a ninth decile of 7.5%. The median of the retention of $^{131}I$-rose bengal was 32%, with a ninth decile of 39.4%. The variance in retention values of both BSP and $^{131}I$-rose bengal was similar in all age groups. The data illustrate the necessity of histologic confirmations of liver normalcy in studies of this nature. Had the data from the ten subjects excluded from the study on the basis of their liver biopsy results been included, the results of the study would have been seriously distorted, especially with regard to the retention of BSP and $^{131}I$-rose bengal.

7578 ALCOHOL AND ITS DRUG INTERACTIONS. *(E.)* Seixas, F. A. (Natl. Council Alcoholism, Room 1720, 2 Park Ave., New York, N.Y. 10016). *Ann. Intern. Med.* 83(1):86-92, 1975.

The absorption and metabolism of alcohol are reviewed, as are alcohol-drug interactions of importance in current clinical practice in the United States. Alcohol is absorbed from the mucous membranes of the oral cavity, stomach, and intestines, producing an inflammation at all these sites. Ethanol enhances the absorption of antibiotics, nitroglycerine, and industrial toxins such as mercury vapor and lead. The major pathway of alcohol metabolism is through oxidation in the liver by the zinc-containing enzyme, alcohol dehydrogenase, to acetaldehyde. Alcohol dehydrogenase also metabolizes drugs such as methanol and ethylene glycol and is inhibited by phenylbutazone and the diuretic, ethacrynic acid. There is considerable evidence to indicate that, at higher doses of ethanol, the activity of alcohol dehydrogenase remains constant and the alcohol induces the oxidizing activity of the hepatic microsomes. Since warfarin, dilantin, and tolbutamide are also metabolized by the microsomal ethanol-oxidizing system, the half-lives of these drugs are reduced in alcoholic subjects; $CCl_4$ toxicity is enhanced in alcoholics by a similar mechanism. In addition, alcohol decreases the plasma cation, potassium, and magnesium concentrations, can lower the plasma phosphate concentration, increases the plasma uric acid concentration, interferes with hepatic gluconeogenesis, and interacts with puromycin C to produce fatty liver. When alcohol is taken after pretreatment with disulfiram, flushing, tachycardia, dyspnea, and shock occur; a similar reaction occurs when alcohol is taken in conjunction with calcium carbamide, phentolamine, chloramphenicol, tolbutamide, furazolidone, griseofulvin, quinacrine, and metronidazole. General analeptics, such as picrotoxin and pentylenetetrazole, tend to produce convulsions in the presence of large amounts of alcohol, and milder stimulants increase the deterioration of performance with smaller doses of ethanol. All sedative-hypnotic drugs act synergistically or at least additively with alcohol and a wide variety of congeners found in alcoholic beverages may produce heightened gastrointestinal distress, acute hypertensive crisis, or cardiomyopathy. The physician is cautioned about the use of alcohol by patients taking other medications and about the difficulty frequently encountered in ascertaining the extent of the patient's alcohol ingestion.

7579 A SPECIFIC HEPATOBILIARY ALKALINE PHOSPHATASE: 5'-NUCLEOTIDASE. *(Fr.)* Moretti, G.; Staeffen, J.; Ballan, P.; Ferrer, J.; Dubecq, J. P.; Roques, J. C.; Beylot, J.; Broustet, A.; Amouretti, M.; Series, C. (St. Andre Hosp., Bordeaux, France). *J. Med. Lyon* 54(1240):37-56, 1973.

The serum 5'-nucleotidase levels were studied in 650 patients with different diseases. The upper limit of the normal value was fixed at 15 IU/l in 120 normal subjects. For children (40 cases), pregnant women (65 cases), aged persons (12 cases), and subjects with various bone diseases (19 cases), the 5'-nucleotidase levels were normal but the alkaline phosphatase levels were significantly elevated. The alkaline phosphatase level was elevated in all 19 cases of metastatic bone cancers of various origin, but the 5'-nucleotidase was abnormally high in only seven cases. The alkaline phosphatase levels were elevated in 97% of the 27 cases of secondary cancer of the liver, and the 5'-nucleotidase level was elevated in 90% of all cases, thus indicating the hepatic origin of alkaline phosphatase. The 5'-nucleotidase level was above normal in all ten cases of primary liver cancer. The 5'-nucleotidase and alkaline phosphatase levels were elevated in 52% and 61% of the 56 cases of compensated alcoholic cirrhosis, and in 30% and 70% of all cases of decompensated alcoholic cirrhosis, resp. The 5'-nucleotidase levels fluctuated between very high and normal levels in 30 cases of viral hepatitis. Increased 5'-nucleotidase levels up to 230 IU/l were found in 34 cases of persistent cholestasia by subhepatic obstruction. Elevated 5'-nucleotidase was significantly correlated with increased alkaline phosphatase throughout the study, while a number of conditions produced a rise in alkaline phosphatase without a corresponding rise in the 5'-nucleotidase level. It is concluded that 5'-nucleotidase increases in all conditions in which hyperphosphatemia is of hepato-biliary origin. This rise is marked in cholestasis of neoplastic or lithiasic origin.

7580 USE OF FACTOR-VII-RICH PROTHROMBIN COMPLEX CONCENTRATE IN LIVER DISEASE. *(E.)* Green, G.; Dymock, I. W.; Poller, L.; Thomson, J. M. (Univ. Hosp. South Manchester, England). *Lancet* 1(7920): 1311-1314, 1975.

An attempt was made to improve blood coagulation with parenteral administration of a prothrombin complex concentrate of factors II, VII, IX, and X. Of 13 patients studied, seven had cirrhosis, two chronic active hepatitis, two drug-induced hepatitis, and two collagen disorders associated with hepatocellular dysfunction. If prothrombin time was abnormal, vitamin $K_1$ was given (10 mg/day for three days, i.m.) and prothrombin time was again determined. In patients whose prothrombin time was still 3 sec or more longer than the control 72 hr after vitamin $K_1$ administration, the concentrate was infused before liver biopsy. There was no clinical evidence of bleeding during liver biopsy in any patient. Prolonged prothrombin time improved in every case: preinfusion values ranged from 15 to 20 sec (mean 17), compared with postinfusion values of 15 sec or less (normal, 11-13). Preinfusion factor VII levels ranged from 25% to 70% (mean 44%), compared with postinfusion activities of 100% or more (mean, 135%). Prolonged cephalin times were recorded in six cases before treatment, but there was a significant shortening at four hr after infusion from a mean of 60 sec to 51.5 sec (normal, 38-45 sec). There was a significant elevation of factor V levels postinfusion. No changes were observed in platelet count or euglobulin lysis times. Prolonged thrombin fibrinogen time preinfusion persisted after infusion. It is concluded that the factor-VII-rich concentrate may be the treatment of choice in patients with liver disease who require a temporary correction of their coagulation defect.

7581 THE EFFECT OF INTRAVENOUS TRANSFUSION OF FAT EMULSIONS ON LIVER STRUCTURE. *(Rus.)* Raikhlin, N. T.; Sudzhan, A. V. (Inst. Exp. Clin. Oncol., Moscow, U.S.S.R.) *Eksp. Khir. Anesteziol.* (1):79-81, 1975.

Morphological studies were conducted on liver biopsies taken during surgery from 31 patients with cancer of the esophagus and stomach who had been given i.v. infusions of 10% and 20% Intralipid (soybean oil emulsion) and 15% Lipofundin (cotton seed oil emulsion) preoperatively. Side reactions consisted of fever, tachycardia, facial hyperemia, nausea, and occasional chills. A characteristic lipid pigment was detected in the Kupffer cells and the endothelium of hepatic blood vessels in six patients who had been given four or five infusions of 15% Lipofundin and in three patients who received six infusions of 20% Intralipid. No pigment deposits were observed in any of the patients who received 10% Intralipid. The clinical significance of these deposits is unknown. No other changes were observed which might be attributed to the fat emulsions.

7582 RECONSTRUCTION OF INTRAHEPATIC BILE DUCTS IN CONGENITAL BILIARY ATRESIA. *(E.)* Chiba, T.; Kasai, M.; Sasano, N. (Tohoku Univ. Sch. Med., Sendai, Japan). *Tohoku J. Exp. Med.* 115(2): 99-110, 1975.

The major intrahepatic bile ducts extending from the portal hepatic vein to the periphery of the liver were studied in cases of biliary atresia. Case reports are also presented. Autopsy specimens obtained from seven cases of biliary atresia were fixed, cut into blocks of tissue 2000-2500 μm, and dehydrated with alcohol. The blocks were paraffin-embedded in six cases, and celloidin-paraffin embedded in the last case. Serial sections (6 μm) were stained with elastica-Masson and hematoxylin and eosin. Gross findings of the extrahepatic bile ducts were classified as Kasai type I in two cases, type II in one case, type IIIa in one, and type IIIb in the remaining three cases. The main intralobular bile ducts were usually patent throughout the whole length of the liver, regardless of the type of extrahepatic biliary atresia. Microserial reconstruction of bile ducts and ductules of a small portal tract performed in one case (a female, aged four and one-half months at death) showed a number of ductules forming a network around the main duct, and in some cases, communicating with it. The postoperative complication

of severe ascending cholangitis seemed to be an important cause of destruction or disappearance of intrahepatic bile ducts in one case, a female aged seven and one-half months at death. These data support the suggestion that active secretion of bile is present in many patients after operation for biliary atresia, and is seen in older infants without the postoperative complication of ascending cholangitis. Operation for biliary atresia early in life is recommended.

7583 OMENTAL ARTERIOVENOUS FISTULA FOLLOWING LIVER BIOPSY. *(Eng.)* Satava, R. M.; Van Heerden, J. A.; Sheedy, P. F., II; Summerskill, W. H. J. (Mayo Clinic, Rochester, Minn. 55901). *Gastroenterology* 69(2):492-495, 1975.

A case of iatrogenic omental arteriovenous fistula attributable to an earlier unsuccessful liver biopsy is described. A 29-yr-old woman was hospitalized with a 24-hr history of large, bloody stools, vague lower abdominal cramps, and a recent onset of fatigue. The pertinent history included quiescent chronic ulcerative colitis, diagnosed 13 yr earlier, and chronic active liver disease. In addition, 5 yr previously she had undergone a splenorenal shunt for massive upper gastrointestinal bleeding from esophageal varices. A liver biopsy performed 3 yr prior to admission revealed no liver tissue; the biopsy was technically difficult, required several passes and the use of two needles, and was followed by pain in the upper right quadrant which required further hospitalization. The patient had been asymptomatic for the 5 yr preceding her present admission. The liver was palpable and there was a loud continuous bruit over the right upper quadrant of the abdomen. However, there was no jaundice nor cutaneous stigmas of chronic liver disease, nor any evidence of ulcerative colitis. The patient was given transfusions to raise her lowered serum hemoglobin (9.9 g/dl), but the stools remained guaiac-positive. The results of a barium enema and upper gastrointestinal series were normal. A visceral angiogram, however, revealed a large arteriovenous fistula located adjacent to the hepatic flexure of the colon with the major arterial supply arising from the right gastroepiploic artery and from an epiploic branch of the right colic artery. A diagnosis of omental arteriovenous fistula was confirmed at laparotomy; the epiploic branch of the right gastroepiploic artery and the epiploic branch of the right colic artery were ligated, whereupon the mass collapsed. Right hemiomentectomy was performed by individually ligating the varices at the serosal surface of the colon. The postoperative course was uneventful, and followup 5 mo later revealed no further symptoms. Visceral arteriovenous fistula should be considered as a cause of gastrointestinal hemmorrhage in patients who have previously undergone liver biopsy, although this is an unusual complication of this procedure.

7584 HAZARDS OF STEROID THERAPY IN HEPATIC FAILURE. *(E.)* Cunliffe, W. J.; Burton, J. L.; Holti, G.; Wright, V. (Gen. Infirm., Leeds, England). *Br. J. Dermatol.* 93(2):183-185, 1975.

Three cases are presented in which patients with skin disease and liver failure (45 to 55 yr old) developed serious systemic side effects from steroid therapy. Two had psoriasis with intermittent erythroderma and one had constitutional eczema. All were chronic alcoholics with hepatomegaly; two were presistently jaundiced. The two psoriatic patients had applied undiluted flourinated steroids (up to 100 g/day) for 3-4 yr. The eczema patient had taken betamethasone (0.5 mg twice daily) for six months. The psoriatic patients developed the cutaneous complications of topical glucocorticoid therapy (purpura, striae and thin skin) as well as Cushingoid facies and buffalo hump. Each had two emergency admissions for malaise, drowsiness, hypotension, erythroderma and dehydration, occuring after failure to apply the corticosteroids for several days. Adrenal insufficiency was diagnosed. All three patients also developed aseptic necrosis of the femoral head of the talus. It is concluded that liver failure was a contributing factor to the development of complications in steroid therapy.

7585 BIOCHEMICAL SERUM INDICES IN VARIOUS LIVER DISORDERS. *(Rus.)* Tokarskaia, Z. B.; Chernova, G. B.; Dorozhko, V. A. (Inst. Biophysics, Moscow, USSR). *Ter. Arkh.* 46(4):53-58, 1974.

The isoenzymic composition of alkaline phosphatase in the blood, present during various liver diseases, was studied to more accurately define diagnostic possibilities and also for the additional characterization of the pathogenic mechanisms of such diseases. Altogether, 160 persons, including a group of 52 practically healthy individuals, a group of 24 individuals in their recovery or preterminal stages (less than 2 mo before their death) having various nonhepatic diseases, such as blood and cardiovacular diseases, acute respiratory diseases, tumors, etc., and a group of 82 individuals in their recovery or preterminal stages with various diseases of the hepato-biliary system were examined for levels of isoenzymes of alkaline phosphatase, lactated hydrogenase, and anomalous lipoprotein X. The presence of anomalous lipoprotein X was the most specific sign of extra- and intrahepatic cholestasis. It was determined that lipoprotein X does not appear immediately after the beginning of jaundice but only 10 to 14 days after its beginning, so it was not observed in quickly-resolved jaundices. The observed increase of the activity of normal hepatic alkaline phosphatase in mechanical jaundice, but not in preterminal conditions and not in parenchymatous hepatitis, was most probably caused by portal hypertension. In all hepatobiliary diseases, the anomalous hepatic fraction of alkaline phosphatase localizing between $\alpha_1$ and $\alpha_2$-globulins was most often revealed. The most mobile hepatic fractions of alkaline phosphatase localizing in the cathode region of albumins were revealed in severe preterminal conditions both accompanied by jaundice and without it. Significant increase in intestinal alkaline phosphatase content was observed in liver cirrhosis; less significant increases were seen in infectious hepatitis. The long-term corticosteroid therapy in adults caused appearance of a small amount of bone alkaline phosphatase.

7586 LIVER DISEASE IN INFANCY: HISTOLOGICAL FEATURES AND RELATIONSHIP TO $\alpha_1$-ANTITRYPSIN PHENOTYPE. *(E.)* Talbot, I. C.; Mowat, A. P. (King's Coll. Hosp., London, England). *J. Clin. Pathol.* 28(7): 559-563, 1975.

The specificity and frequency of periodic acid-Schiff (PAS)-positive material in tissues of $\alpha_1$-antitrypsin deficient (PiZZ) infants was investigated. Sixty-six liver biopsies and three postmortem liver specimens from 53 infants with neonatal hepatitis were examined without knowledge of the PiZZ state. In three cases, all PiZZ, cholestatic hepatitis was accompanied by glandular transformation of periportal hepatocytes and prominent dilated periportal ductular structures near the canals of Hering. Evidence of more active infiltration with a more dense infiltrate was seen in follow-up biopsies of two PiZZ individuals. Diastase-resistant, PAS-positive, pure magenta-colored, sharply defined globules (2-20 μ in diameter) were found in periportal and periseptal hepatocytes of eight infants biopsied after 12 weeks of age. These globules were distinct from the irregular fragments of similar periportal Kupffer cells or microphages of liver tissue irrespective of the Pi state. PAS-positive globules in liver parenchyma cells are a useful diagnostic feature of $\alpha_1$-antitrypsin deficiency in infants of more than 12 weeks of age.

7587 DEFICIENCY OF $\alpha_1$-ANTITRYPSIN. *(Dut.)* Jansveld, C. A. F.; Dijkman, J. D. (Univ. Clinic Internal Diseases, Longartsen, The Netherlands). *Ned. Tijdschr Geneeskd.* 118(36):1366-1372, 1974.

Symptomatology, genetic and pathophysiological aspects, and prevalence of $\alpha_1$-antitrypsin deficiency are discussed on the basis of three cases. Dyspnea was the first symptom of the disease in three male patients between 30 and 40 yr of age. Pulmonary emphysema and symptoms of chronic obstructive pulmonary disease type A were determined. All three patients were homozygous for the $Pi^Z$ gene (phenotype, PiZZ) for which a serum $\alpha_1$-antitrypsin level of 15% of the normal value is characteristic. Significant reduced serum $\alpha_1$-globulin, $\alpha_1$-antitrypsin level and activity were found in all three cases. Acidophilic material and PAS-positive globules may be present in the liver. Emphysema in $\alpha_1$-antitrypsin deficiency is probably due to gradual disintegration of lung tissues as a result of the insufficient inhibition of proteases released from lung macrophages, leukocytes, or bacteria. Deficiency of $\alpha_1$-antitrypsin also causes a predisposition to neonatal hepatitis and to cirrhosis in children and adults. The prevalence of phenotype PiZZ is estimated at one in 1,000 to one in 2,000 births. Intermediary $\alpha_1$-antitrypsin deficiency (phenotype PiMZ) occurs in about 5 to 6% of the population, but its symptomatology is slight.

7588 NONCIRRHOTIC PRESINUSOIDAL PORTAL HYPERTENSION ASSOCIATED WITH CHRONIC ARSENICAL INTOXICATION. *(E.)* Huet, P. M.; Guillaume, E.; Cote, J.; Legare, A.; Lavoie, P.; Viallet, A. (Saint-Luc Hosp., Montreal, Canada). *Gastroenterology* 68(5):1270-1277, 1975.

A case report is presented of a 39-yr-old man with idiopathic portal hypertension after prolonged ingestion of an arsenic preparation. The patient had an 11-yr history of psoriasis, for which the arsenic had been prescribed. There was no history of liver disease or alcohol abuse. Splenomegaly but not hepatomegaly was observed. Liver function tests were normal. Esophagogastroscopy showed esophageal varices more than 4 mm wide without gastric lesion. Deep needle biopsy of the liver showed nonspecific changes and slight dilation of portal veins in some of the portal tracts. Esophageal varices, a patent portal vein, and an unusual intrahepatic portal vein distribution were seen on retrograde splenography and portagraphy. There was dilation, tortuosity, and anarchic orientation of portal vein radicles up to the periphery of the liver, with opacification of a capsular network. Superior mesenteric and celiac arteriographies showed an unusually large (11 mm wide) and tortuous splenic artery. The portohepatic gradient was 17 mm Hg (normal, less than 5 mm Hg). The diagnosis was idiopathic perisinusoidal portal hypertension with patent portal vein and normal liver architecture. A splenorenal anastomosis was performed three weeks after admission. Wedge biopsy of the left lobe of the liver showed normal liver morphology, except for slight dilation of 25% of the small portal branches and nonspecific focal necrosis. The postoperative course was uneventful. This case and three others previously reported suggest that arsenic may have a toxic effect on the liver, leading to portal hypertension without cirrhosis.

7589 GALLBLADDER AND LIVER INFARCTION OCCURRING AS A COMPLICATION OF ACUTE BACTERIAL ENDOCARDITIS. *(E.)* Henrich, W. L.; Huelmergarth, R. J.; Rosch, J.; Melnyk, C. S. (Univ. Oregon Med. Sch., Portland). *Gastroenterology* 68(6):1602-1607, 1975.

A case of acute bacterial endocarditis is described in which systemic embolization was a striking feature with involvement of the cystic and hepatic arteries. A 45-yr-old woman was hospitalized with a 3-day history of fever, chills, increasing dyspnea, and malaise. There was no prior history or symptoms suggestive of gallbladder or liver disease. There were numerous splinter hemorrhages in the nail beds and petechial lesions on the volar surfaces of the fingers, toes, soles of the feet, and in the conjuctivae and fenulum of the tongue. Subcrepitant rales were present in both lungs. The bowel sounds were slightly hypoactive and there was tenderness in the left upper quadrant that had the murmur of mitral regurgitation on auscultation. Mild pulmonary vascular congestion, slight cardiomegaly, and sinus tachycardia were further revealed. The presumptive diagnosis of acute bacterial endocarditis was confirmed by blood cultures positive for coagulase-positive *Staphylococcus aureus*. Therapy included penicillin, nasal oxygen, and digitalization. The patient began to pass frequent bloody stools, and visceral arteriography revealed massive intestinal bleeding from an arteriovenous fistula. I.v. Pitressin infusion (0.2 μ/min) was effective in stopping the bloody diarrhea. Eighteen hr later, the patient complained of exquisite right upper quadrant pain. Laparotomy revealed a black infarcted gallbladder

and multiple hepatic infarcts. A cholecystectomy was performed and several terminal ileal and cecal arteries supplying the arteriovenous malformation were ligated to prevent further bleeding. Twenty-four hr later, the patient again began to pass bloody stools and several days later the terminal ileum and proximal right colon were resected. The patient had an uneventful convalescence thereafter with no further intestinal bleeding; but just before discharge she suddenly became hypotensive, had a cardiorespiratory arrest, and could not be resuscitated. At autopsy, 2 liters of blood were found in the right upper abdominal quadrant, areas of necrosis were identified on the right hepatic lobe, an infarct was observed in the right kidney, and there was an acute endocarditis of the mitral valve. Death appeared to have resulted from i.p. bleeding due to erosion of an hepatic artery adjacent to an area of hepatic infarction. It is concluded that in a setting of multiple embolic events from acute bacterial endocarditis, gallbladder infarction should be included in the differential diagnosis when right upper quadrant pain or signs and symptoms of acute abdomen appear.

7590 MANAGEMENT OF ENDOGENOUS HEPATIC COMA. *(Ger.)* Czygan, P.; Ast, E.; Kommerell, G. (Medizinische Universitatsklinik, 6900 Heidelberg, Bergheimer Strasse 58, Germany). *Inn. Med.* 2(3): 172-178, 1975.

Different methods used to treat hepatic coma are reviewed. Mortality rates in patients given exchange transfusions, plasmapheresis, homologous and heterologous cross-circulation, and immunotherapy with hepatitis B immunoglobulin do not differ appreciably from those obtained in patients receiving basic therapy even though the methods mentioned cause temporary improvement of hepatic encephalopathy. Extracorporeal perfusion, using baboon liver, does not appear to reduce the mortality and is not accompanied by complications such as hemorrhagic diathesis, hyaline membrane disease, or refractory hypoglycemia. A mortality of 41.5% has been obtained with the rapid wash-out method, but the technique is difficult and requires specially trained personnel. In one study, L-dopa improved hepatic encephalopathy significantly in five of nine patients, but no other investigators have been able to confirm these results. Perfusion of blood, using activated charcoal to adsorb toxic substances, offers a simple method which is safe for both the patient and medical personnel. Survival rates of patients treated with this technique appear to be about 40%. When the author employed this method using activated charcoal coated with collodion on five patients, two improved but only one survived. No microembolisms were detected in any of the 17 treated patients who died. The cause of death was massive cerebral edema in more than 70%.

7591 ENTEROHEPATIC ACRODERMATITIS: A ZINC DEFICIENCY SYNDROME? *(Nor.)* Krogh, H. K.; Syversen, T. (General Dept., Haukeland Hosp., Haukeland, Norway). *Tikskr. Nor. Laegeforen* 95(3):152-155, 1975.

Enterohepatic acrodermatitis as a zinc deficiency syndrome is discussed on the basis of two obstinate cases in a brother and sister. The disease appeared in both cases at an age of 3 to 4 mo after the termination of breast-feeding. Prolonged therapy with Diodoquin (diiodo-8-hydroxyquinoline) and Siosteran (dichloro-8-hydroxyquinoline) was not successful; relapses kept occurring. The abnormally low zinc level in the serum prompted Solvezink therapy (135 mg/day, p.o.) which resulted in total normalization in about 6 mo, and in a slightly above-normal serum zinc level. The serum zinc levels were normal in the parents. The findings indicate that zinc deficiency due to reduced absorption as a result of chelate formation with an oligopeptide may be an essential etiological factor in enterohepatic acrodermatitis. The manifestation of the disease after the termination of breast-feeding is probably due to the reduced zinc content of cow milk as compared with mother's milk.

7592 HEPATIC DISEASE IN ERYTHROPOIETIC PROTOPORPHYRIA. *(E.)* Bloomer, J. R.; Phillips, M. J.; Davidson, D. L.; Klatskin, G. (Yale Univ. Sch. Medicine, New Haven, Conn. 06510). *Am. J. Med.* 58(6):869-882, 1975.

Studies of hepatic structure and function were made in two sisters with erythropoietic protoporphyria. The first patient (33 yr old) had life-long jaundice and photosensitivity. Autopsy showed a patent extrahepatic biliary tree, a dark black, nodular liver weighing 2690 g, and a congested spleen weighing 1700 g. The second patient (26 yr old) was not jaundiced but was photosensitive. Their maternal grandfather had no liver disease but did have photosensitivity, and died at age 88 yr. The first sister exhibited BSP retention of 13.5% and slightly increased SGOT (43 U). Wedge biopsy and autopsy specimens showed an active cirrhosis with massive amounts of protoporphyrin in Kupffer cells, portal histiocytes, bile canaliculi and parenchymal cytoplasm. The second sister showed a small increase in BSP retention (11.7%) and SGOT (69 U). Needle biopsy showed portal inflammation with erosion of limiting plates, occasional bridging between triads and central areas of cell dropout. Protoporphyrin pigment was present in portal histiocytes, areas of central collapse, and, more rarely, in parenchymal cytoplasm. RBC and plasma protoporphyrin concentrations were markedly increased above normal in both cases. These data support previous observations that hepatic involvement may be an integral aspect of erythropoietic protoporphyria.

7593 HEPATIC GRANULOMAS CONTAINING COPPER IN WORKERS WHO TREAT GRAPES WITH COPPER SULFATE: A NEW TYPE OF HEPATIC GRANULOMA. *(Por.)* Pimental, J. C.; de Menezes, A. P. (Fac. Med., Lisbon, Portugal). *J. Med. (Oporto, Port.)* 87(1639):13-16, 1975.

Case reports are presented for 3 men, aged 51, 59, and 52 yr, resp., who developed copper-containing hepatic granulomas, associated with pulmonary lesions,

after dusting grapes with copper sulfate for 3, 12, and 15 yr, resp. In the first case, hepatic granulomas were found only at autopsy; the patient died as a result of bilateral pneumothorax. Multiple pulmonary granulomas contained many inclusions of copper. The second patient, an alcoholic, was hospitalized with hepatomegaly, hypergammaglobulinemia, and hypoalbuminemia; turbidity tests were positive and SGOT and SGPT levels were increased. This patient died in a coma; autopsy showed micronodular cirrhosis, esophageal varices, and mild ascites. The third patient presented with hepatomegaly, hypergammaglobulinemia, and positive turbidity tests; SGOT, SGPT and alkaline phosphatase values were within normal limits. The patient responded to broad-spectrum antibiotics. Histological examination of a liver biopsy from this patient and autopsy of the first two patients showed that two types of granulomas were present in the liver: (1) rounded or oval nodules consisting of histiocytes and similar to granulomas found in the lungs of these patients, and (2) granulomas consisting of epithelioid cells organized into sarcoid-type follicles. Granulomas were accompanied by structures consisting of reticular fibers in all three patients. A few lymphocytes were detected inside of and around the granulomas. Cells forming these lesions contained varying numbers of fine granules which gave a positive reaction for copper with rubianic acid. Copper was also detected in focalized and diffusely proliferating Kupffer cells. Serial sections and 3-dimensional reconstructions of some areas of hepatic tissue demonstrated that granulomas and nodular, sclerohyaline scars were located in the portal spaces, while examination of isolated sections suggested that they were located between the lobules. In the patient with cirrhosis, granulomas were present in fibrous bands surrounding nodules of liver tissue.

7594 CLINICAL AND BIOCHEMICAL FEATURES OF HYPERTRIGLYCERIDEMIA IN LIVER DISEASE. *(Ger.)* Linhart, P.; Kommerell, B.; Erbe, R.; Seidel, D. (Med. Clin. Univ. Heidelberg, Germany). *Inn. Med.* 9(2): 73-79, 1974.

To determine whether hypertriglyceridemia is the result of certain liver diseases or is associated with specific disorders in liver function, serum triglyceride levels were determined on 500 patients hospitalized with a variety of liver diseases and attempts were made to establish correlations between triglyceride levels and other liver function tests. Correlations significant on the 0.1% level were found between serum triglyceride concentrations and serum bilirubin concentrations and the presence or absence of lipoprotein-X. No correlations were observed between triglyceride concentrations and the Quick time. These findings suggest that increases in serum triglyceride concentrations in liver disease are due to cholestasis or increased serum bilirubin concentrations rather than to parenchymal liver damage. Fractionation of lipids in fasting blood samples from 32 patients, aged 19 to 66 yr, with acute hepatitis (27 cases), chronic hepatitis (three cases) and extrahepatic cholestasis (two cases) showed the presence of an abnormal, low-density lipoprotein ($\beta_2$-lipoprotein) in 15 cases. All of these 15 patients had hypertriglyceridemia. The abnormal lipoprotein differed from lipoprotein-X and from normal lipoproteins. It was never detected in blood from any of the ten patients who did not have hypertriglyceridemia. In most patients, this $\beta_2$-lipoprotein was associated with intra- or extrahepatic cholestasis, but it was not found in all patients with positive tests for lipoprotein-X. Although the absolute triglyceride content of the very low density lipoprotein (VLDL) fraction was slightly increased in most patients with the abnormal $\beta_2$-lipoprotein, the relative triglyceride concentration in the VLDL fraction was significantly decreased in all cases. This demonstrates that triglyceride-rich lipoproteins are present in the serum fraction having a density greater than 1.006 g/ml. It is suggested that the presence of the abnormal $\beta_2$-lipoprotein in fasting plasma from patients with liver disease and hypertriglyceridemia is due to decreased lipase activity in the liver since postheparin lipase activity, determined with either $^{14}$C-trioleate or lipoprotein as the substrate, was significantly decreased in patients with the $\beta_2$-lipoprotein.

7595 IMMUNOGLOBULINS AND INFLAMMATORY LIVER DISEASES. *(Ger.)* Bauch, K. (Kuchenwald Dist. Hosp. Clin., Karl Marx Stadt, Germany). *Z. Aeratl. Fortbild. (Jena)* 69(4):169-172, 1975.

Quantitative immunoglobulin determinations can be used in the diagnosis of acute hepatitis and primary biliary cirrhosis since these diseases are accompanied by characteristic changes in the immunoglobulin (Ig) pattern. However, immunoglobulin determinations are of no value in the diagnosis of chronic persistent and chronic aggressive hepatitis and cirrhosis. In general, increases in IgG are associated with inflammatory changes, while increases in IgA accompany fibrosis and pseudolobuli formation. There are conflicting opinions about the value of immunoglobulin determinations for establishing the prognosis of patients with liver disease. IgG and, to a lesser extent, IgA concentrations tend to decrease when patients with chronic liver disease are treated with immunosuppressive agents, but these changes are not necessarily correlated with clinical findings and are correlated with changes in histological findings in only one-half of all cases. Of serum turbidity tests (thymol turbidity test, Takata-Ara reaction, and zinc sulfate turbidity test), only the results from zinc sulfate turbidity test correlate with changes in the immunoglobulin pattern. No positive correlations were found between SGOT and SGPT values and immunoglobulin concentrations.

7596 THE DIFFERENTIAL DIAGNOSIS BETWEEN INTRAHEPATIC CHOLESTATIC JAUNDICE AND VIRAL HEPATITIS DURING PREGNANCY. *(E.)* Piccinino, F.; Manzillo, G.; Sagnelli, E. (Faculta Medicina Universita Napoli, Via Cotugno 1, J-80135 Napoli/Italien). *Acta Hepato-Gastroenterol.* 22(3):144-150, 1975.

Clinical and laboratory findings from 15 patients with icteric viral hepatitis during pregnancy (VHP)

and from 22 patients with intrahepatic cholestasis during pregnancy (CJP) were evaluated statistically to determine which parameters might help in differentiating between the two diseases. Diagnosis was established by needle liver biopsy in all cases. The following data were considered: history, physical examination, erythrocyte sedimentation rate (ESR), serum cholesterol, prothrombin time, total serum bilirubin, SGOT, SGPT, serum alkaline phosphatase, serum protein, serum flocculation tests, BSP blood clearance and serum hepatitis B antigen (HB Ag). Vomiting, high serum levels of GOT and GPT, and serum HB Ag positivity were correlated with VHP. A severe itching with scratching lesions, high ESR, elevated total cholesterol and serum alkaline phosphatase values were consistent with a diagnosis of CJP, especially when these symptoms occur in the later stage of pregnancy. On the basis of the clinical and biochemical data, a correct diagnosis was possible in only 11 of the 15 cases of VHP and in only 19 of the 22 cases of CJP. In the remaining seven cases, diagnosis could be established only on the basis of liver biopsy. Thus, while clinical and biochemical data are useful for a preliminary screening of patients with jaundice during pregnancy, diagnosis on this basis may be difficult in some cases and liver biopsy remains a simple means of obtaining a correct diagnosis.

7597 A STUDY OF TWO CASES OF INTRATHORACIC HEPATIC HETEROTOPIA. *(Fr.)* Desvignes, G.; Mary, H.; Levasseur, P.; Aubert, A.; Petithomme, H.; Terrazas, G.; Thevenet, A.; Merlier, M. (Centre Chirurgical Marie-Lannelongue, 129, rue de Tolbiac, 75013 Paris). *Ann. Chir. Thorac. Cardio-vasc.* 14(2): 177-180, 1975.

Two cases of intrathoracic hepatic heterotopia were investigated in detail. Hepatic tissue ectopies were generally presented under two aspects: as a supernumerary lobe, or as a nodule included in the wall of other abdominal organs. In all cases they could be considered either as accessory livers or as ectopic lobes varying between 3 and 15 cm in diameter. The first patient had mixed thoraco-abdominal ectopy over and beneath the diaphragm; no biliary canal had been individualized. The second patient presented a more unusual case since the hepatic nodule was included in the pulmonary tissue of the inferior right lobe, creating a real intrapulmonary sequestration. These ectopic livers were vascularized by systemic arteries, stemming from either the aorta or normal hepatic arteries. The venous blood was always channeled to the inferior vena cava. In our first patient the thoracic hepatic ectopy was accompanied by a costo-vertebral anomaly. In the second patient a hepatic hernia from a Bochdalek foramen was present. These hepatic sequestrations were often hard to distinguish from the extralobar broncho-pulmonary ones. Excision is justified if the risk of cancer development is sufficiently great.

7598 EPIDEMIOLOGIC INVESTIGATION OF REYE SYNDROME. *(E.)* Stechenberg, B. W.; Keating, J. P.; Koslov, S.; Schecter, M.; Chang, M.; Haymond, M. W.; Feigin, R. D. (St. Louis Children's Hospital, 500 S. Kingshighway, St. Louis, Mo. 63110). *J. of Pediatr.* 87(2):234-237, 1975.

A survey was made to determine the relation between Reye syndrome and viral illness in a community. Sera were collected five weeks apart from 136 classmates of patients with Reye syndrome. School attendance records were kept during the experimental period. Inactivated sera samples were tested for complement-fixing antibodies to adenovirus, influenza A, B, and C, parinfluenza I, II, and III, respiratory syncytial virus, and varicella. A four-fold change in titer was considered as an acute infection. As many as 81% of the children had evidence of recent infection with influenza B virus. SGOT and SGPT concentrations were normal. This report represents the first serologic study of school contacts of patients with Reye syndrome and strongly supports the concept that Reye syndrome may be related to a viral illness. The occurrence of Reye syndrome in an individual must reflect the difference in host response to these viral illnesses. The specific role of influenza B infection with Reye syndrome remains unclear.

7599 CLINICAL TRENDS AND TOPICS. REYE'S SYNDROME (ENCEPHALOPATHY AND FATTY LIVER): DIAGNOSIS AND TREATMENT. *(E.)* Partin, J. C. (Children's Hosp. Research Foundation, Elland and Bethesda Ave., Cincinnati, Ohio 45229). *Gastroenterology* 69(2):511-518, 1975.

The clinical diagnosis and treatment of Reye's syndrome is reviewed. This condition is an acute encephalopathy which is associated with a panlobular microvesicular fatty liver. In untreated cases there is a progressive increase in brain swelling (edema), and an elevation of serum transaminases, plasma free fatty acids, blood ammonia, as well as a prolongation of prothrombin time. Liver glycogen falls, reaching a hypoglycemic state. The disease is consistently associated with a prodromal viral infection, attacking the patient within the first six years. The actual cause of the syndrome is unknown. The parenchyma of the liver and brain are injured simultaneously. Neurological signs range from lethargy, vomiting and headache to agitated delirium and coma. Liver biopsy is usually required, with fat stains recommended due to possible color loss in formalin and failure of H & E staining to reveal droplet accumulation. Mild cases are treated by correcting electrolyte balance with severe cases requiring peritoneal dialysis, intensive supportive care and continuous glucose infusion. Mannitol (1.5-2.0 g given over 15 min) every 6 hr is used to control cerebral edema. Corticosteroids are not used due to their production of gastrointestinal bleeding. The pathophysiology of this disease calls attention to the important interrelation between liver and brain functions.

7600 POSSIBLE PATHOGENIC ROLE OF ENDOTOXIN IN REYE'S SYNDROME. *(E.)* Cooperstock, M. S.; Tucker, R. P.; Baublis, J. V. (Univ. Michigan Med. Cent., Ann Arbor). *Lancet* 1(7919):1272-1274, 1975.

The *Limulus* assay was used to investigate endotoxin-like activity in plasma and cerebrospinal fluid of 11 children with Reye's syndrome and in controls. Of 20 plasma samples from nine patients who became fully comatose in the first five days of central nervous system illness, the endotoxin-like activity ranged from 1-3000 ng/ml (mean, 30 ng/ml). Sequential studies were made of five of these patients. Declining levels were associated with clinical improvement in three, and in the two fatal cases endotoxin-like activity decreased only on appearance of ante-mortem EEG patterns (electrocerebral silence or near-silence). Endotoxin-like activity rose in one case for several days without clinical signs of relapse. Delirium and ataxia were observed in two patients, but they did not become comatose. Plasma endotoxin-like activity levels were 30 ng/ml and undetectable (less than 0.01 ng/ml), resp., during the first day of improvement in neurological symptoms. Plasma *Limulus* activity was not correlated with body temperature, levels of liver enzymes or platelet count. No significant hypotension was found. Endotoxin-like activity was significantly related to polymorphonuclear neutrophil count, and was also related to serum phosphorus depression. A prognostic significance was found for 14 EEGs done within 24 hr of the *Limulus* assay. A positive relation was found between plasma endotoxin-like activity and EEG abnormality in patients during the first four days of neurological symptoms who had not yet reached electrocerebral silence. Endotoxin-like activity was detected in two spinal fluid samples, one from a conscious patient (0.01 ng/ml) and the other from a comatose patient (1.0 mg/ml). The simultaneous plasma level was 300 ng/ml in the latter case. These results suggest that efforts to control intestinal flora in patients with acute reversible hepatic failure be directed towards anaerobic as well as aerobic flora.

7601 BILIARY BILE ACID COMPOSITION IN WILSON'S DISEASE. *(E.)* Cowen, A. E.; Korman, M. G.; Hofmann, A. F.; Goldstein, N. P. (Mayo Clinic, Rochester, Minn.). *Mayo Clin. Proc.* 50(5):229-233, 1975.

**Biliary acid composition and hepatic function were studied in six patients, aged 15-24 yr, with Wilson's disease. The composition of bile obtained by duodenal tube following cholecystokinin stimulation and analyzed by thin-layer and gas chromatography was within normal limits. Total serum deoxycholyl conjugated was lowest in patients with severe liver involvement (as determined by biopsy conventional function tests and the rate of plasma clearance of i.v. injected cholyglycine at 5 uM/kg). The ratio of taurine to glycine conjugates was also normal in all subjects. It is concluded that biliary acid metabolism is normal in patients with Wilson's disease.**

7602 LIPOLYSOSOMES IN HUMAN HEPATOCYTES: ULTRASTRUCTURAL AND CYTOCHEMICAL STUDIES OF PATIENTS WITH WILSON'S DISEASE. *(E.)* Hayashi, H.; Sternlieb, I. (Albert Einstein Coll. Medicine, Bronx, N.Y. 10461). *Lab. Invest.* 33(1):1-7, 1975.

Ultrastructural and cytochemical studies were undertaken to study the subcellular distribution of lipids in the livers of eight untreated and five D-penicillamine-treated patients with Wilson's disease. Liver biopsy specimens from these patients were examined by light and electron microscopy. Light microscopy revealed slight to severe fatty changes, fibrosis, mononuclear cell infiltrations, and/or occasional focal necrosis in seven specimens. Fatty changes were still evident in two of three patients after 4 to 16 yr of D-penicillamine therapy. Histochemical studies showed acid phosphatase reaction product around some of the lipid droplets in the specimens. Most of the lipid droplets in the hepatocytes appeared as homogeneous, electron-lucent vacuoles with or without a fine electron-dense layer at the periphery; there were no enveloping trilaminar unit membranes. Randomly distributed throughout the same hepatocytes were lipolysosomes, which accounted for 1 to 2% of the lipid droplets observed. They appeared as vacuoles surrounded by electron-dense material, the electron-dense periphery being of a tripartite nature. The lipolysosomes were also characterized by the presence of one or, rarely, two smooth, crescentic, nipple-like, or appendicular projections from their circumferences. These electron-dense projections were often composed of an amorphous, homogeneous matrix which contained the bulk of the acid phosphatase activity. In some lipolysosomes, stacked lamellae and vesicles with granular contents were seen in the electron-dense polar cap. No acid phosphatase reaction product was ever found within the lipid. The occurrence of lipolysosomes in a condition not known to be associated with an acid lipase deficiency suggests that lipolysosomes may represent a nonspecific, alternate route for the mobilization of excess lipid from hepatocytes.

7603 LIGATURE OF THE HEPATIC ARTERIES FOR METASTASES OF A CARCINOID TUMOUR. *(Fr.)* Chiche, B.; Morin, Y.; Marrai, O.; Carli, C. (Hosp. Cochin, Paris, France). *Nouv. Presse Med.* 4(17):1279-1281, 1975.

7604 THE USE OF WOFAVERDIN DYE IN THE STUDY OF HEPATIC BLOOD FLOW. *(Rus.)* Fomichev, V. I. (Moscow Med. Stomatol. Inst., USSR). *Klin. Med.* 53(1):71-73, 1975.

7605 BUDD-CHIARI SYNDROME ASSOCIATED WITH A PiS OR PiSO TYPE $\alpha_1$-ANTITRYPSIN DEFICIENCY. *(Fr.)* Lammens, P.; Levy, V. G.; Martin, J. P.; Feldman, G.; Caroli, J. (CHU St. Antoine, 75012 Paris, France). *Med. Chir. Dig.* 3(6):409-415, 1974.

7606 HEPATIC VENOGRAPHY OF HEPATOMA. *(Jpn.)* Watanabe, T.; Hiramatsu, K.; Matsuyama, S.; Nagai, J.; Nishioka, K. (Keio University Medical School, Japan). *Rinsho Hoshasen (Jap. J. Clin. Rad.)* 20(2):119-125, 1975.

7607 PYOGENIC UNILOCULAR ABSCESS OF THE LIVER. *(Fr.)* Kayabali, I. (Faculty Medicine, Ankara, Turkey). *Lyon Chir.* 71(3):187-188, 1975.

7608 ASSESSMENT OF LIVER FUNCTIONS IN PATIENTS WITH HODGKIN'S DISEASE OBSERVED AT THE DEPARTMENT OF HAEMATOLOGY, INSTITUTE OF HAEMATOLOGY IN THE YEARS 1969-1973. *(Pol.)* Domanska, B. (Instytutu Hematologii w Warszawie, Poland). *Pol. Arch. Med. Wewn.* 53(3):231-240, 1975.

7609 LIVER DIAGNOSIS--CRUX MEDICORUM. *(Ger.)* Anonymous. (no affiliation given). *Diagnostik* 8(8):291-292, 1975.

7610 APPLIED BIOSTATISTICAL ANALYSIS IN THE EVALUATION OF THE PHYSIOPATHOLOGY OF SERUM ALCOHOL DEHYDROGENASE IN HEPATOPATHOLOGY: PRELIMINARY RESULTS. *(It.)* Di Simone, A.; Riegler, G.; Oriani, G. A.; Coltorti, M. (Fac. Med. Chir. I, Univ. Naples, Italy). *Boll. Soc. Ital. Biol. Sper.* 50(18): 1501-1504, 1974.

7611 ENDOSCOPIC CHOLANGIOGRAM AND INTRAVENOUS CHOLANGIOGRAM: AN ANALYSIS OF SIZE COMPARISON. *(E.)* Belsito, A. A.; Marta, J. B.; Dickinson, P. B.; Pizinger, R. J. (United Hosp., St. Paul, Minn.). *Gastroenterology* 68(4):1018, 1975.

7612 KALIKREIN-KININ AND RENIN-ANGIOTENSIN SYSTEMS IN HEPATORENAL (H.R.) SYNDROME. *(E.)* Wong, P. Y.; Talamo, R. C.; Colman, R. W.; Williams, G. H. (Albany Med. Coll., Albany, N.Y.). *Gastroenterology* 68(4):1014, 1975.

7613 NODULAR TRANSFORMATION (NT) OF THE LIVER AND INTRAHEPATIC HEMORRHAGE IN WOMEN ON ORAL CONTRACEPTIVES. *(E.)* Stauffer, J. Q.; Lapinski, M. W.; Honold, D. J.; Myers, J. K. (Upstate Med. Cent., Syracuse, N.Y.). *Gastroenterology* 68(4):991, 1975.

7614 ABNORMAL HEPATIC CHOLESTEROL METABOLISM IN HYPERLIPIDEMIA. *(E.)* Salen, G.; Hicolau, G.; Shefer, S.; Mosbach, E. H. (VA Hosp., East Orange, N.J.). *Gastroenterology* 68(4):978, 1975.

7615 UREA PRODUCTION AFTER PROTEIN LOADING. *(E.)* Rafoth, R.; Onstad, G. (VA Hosp., Minneapolis, Minn.). *Gastroenterology* 68(4):969, 1975.

7616 HEPATOMA AFTER THOROTRAST. *(E.)* Mann, N. S.; Chaudhry, A.; Thaller, S.; Sachdev, A. (Univ. Louisville Sch. Med., Louisville, Ky.). *Gastroenterology* 68(4):945, 1975.

7617 COMBINED SURGERY AND CHEMOTHERAPY IN THE TREATMENT OF PRIMARY AND SECONDARY TUMORS OF THE LIVER. *(Fr.)* Pettavel, J.; Morgenthaler, F. R. (Surgery Dept., Univ. Lausanne, Lausanne, Switzerland). *Schweiz. Med. Wochenschr.* 105(18):596-598, 1975.

7618 THE SIGNIFICANCE OF VARIATIONS IN SOME HEMATOCHEMICAL CONSTANTS IN THE DIAGNOSIS OF HEPATIC METASTASES. *(It.)* Sianesi, M.; Lampugnani, R. (Istituto Patologia Speciale Chirurgica Propedeutica Clinica, Universita Parma, Parma, Italy). *Chir. Patol. Sper.* 22(4):239-254, 1974.

7619 CLINICAL SIGNIFICANCE OF THE DETERMINATION OF FREE BILE ACIDS IN SOME HEPATOBILIARY DISEASES. *(Rus.)* Abramzon, M. A.; Popova, R. A.; Ripatti, P. O. (Medical Faculty, Petrozavodsk Univ., Petrozavodsk, USSR). *Vrach. Delo* (3):72-74, 1975.

7620 HEPATIC ANGIOMA: A CASE OF CAVERNOUS HEMANGIOMA OF THE LIVER IN A BABY GIRL AGED 36 DAYS WHO UNDERWENT AN EMERGENCY OPERATION FOR LEFT LATERAL LOBECTOMY. *(It.)* Gullino, D.; Bianco, G.; Cardino, L.; Giaccardi, A. (Ospedale Maggiore SS. Annunziata, Savigliano, Italy). *Chir. Gastroenterol.* 8(3):342-356, 1974.

7621 THE PATHOGENESIS OF VARIOUS ANATOMICAL AND CLINICAL FORMS OF INTRAHEPATIC CHOLESTASIS. *(It.)* Teodori, U.; Gentilini, P. (Inst. Clinica Medica Generale, Univ. Florence, Florence, Italy). *Arch. "De Vecchi" Anat. Patol. Med. Clin.* 58(1-2-3): 177-211, 1973.

7622 CHARACTERISTICS OF ARTERIOGRAPHY OF THE LIVER IN METASTASIZED LIVER TUMOR. *(Jpn.)* Tsujii, H.; Suzaki, K.; Moriya, H.; Sato, S.; Irie, G. (Sapporo Natl. Hosp., Sapporo, Japan). *Rinsho Hoshasen* 19(9):667-675, 1974.

7623 GIANT VASCULAR TUMOR OF THE LIVER. *(Jpn.)* Tsushima, K.; Tsuchida, H.; Yamagata, N.; Kumakura, N.; Chiba, H.; Sasamura, M.; Ichimura, H.; Abe, F.; Kakizaki, Y.; Tomita, S. (Hirosaki National Hosp., Hirosaki, Japan). *Rinsho Hoshasen* 19(11): 871-876, 1974.

7624 THERAPEUTIC STUDY OF A NEW HEPATOPROTECTIVE AGENT: CONIFERYL POLYHYDROXY-2-PHENYL-CHROMANONE. *(Fr.)* Plomteux, G.; Defrance, P.; Delforge, M.; Crismer, R. (Univ. Hosp. Center, Liege, Belgium). *Ann. Gastroenterol. Hepatol.* 10(6):533-541, 1974.

7625 PRIMARY MESENCHYMOMA OF THE LIVER. ULTRASTRUCTURAL STUDY. *(Fr.)* Lagace, R.; Delage, C.; Robert, J. (Dept. d'Anatomie Pathologique, Hotel-Dieu de Quebec, 11 Cote du Palais, Quebec, G1R 2J6, Canada). *Ann. Anat. Pathol. (Paris)* 19(3):275-286, 1974.

7626 COMPARISON OF THE PHARMACOKINETICS OF THE COMBINATION TRIMETHOPRIM + SULFAMETHOXAZOL IN LIVER PATIENTS AND NORMAL SUBJECTS. *(Ger.)* Rieder, J.; Schwartz, D. E. (Abteilung Fur Experimentelle Medizin, F. Hoffmann-La Roche & Co., Basel, Switzerland). *Arzneim. Forsch.* 25(4):656-666, 1975.

7627 INFANTILE MESENCHYMAL HAMARTOMA OF THE LIVER. HISTOLOGIC AND ULTRASTRUCTURAL OBSERVATIONS. *(E.)* Dehner, L. P.; Ewing, S. L.; Sumner, H. W. (Washington Univ. Sch. Medicine, St. Louis, Mo. 63130). *Arch. Pathol.* 99(7):379-382, 1975.

7628 HOW THE LIVER METABOLIZES FOREIGN SUBSTANCES. *(E.)* Kappas, A.; Alvares, A. P. (no affiliation given). *Sci. Am.* 232(6):22-31, 1975.

7629 CLINICAL AND EXPERIMENTAL LIVER GRAFTING. *(E.)* Calne, R. Y. (Dept. Surgery, Univ. Cambridge, Cambridge, England). *Guy's Hosp. Rep.* 123(1):1-12, 1974.

7630 INTRAOPERATIVE PHYSIOLOGIC MONITORING AND MANAGEMENT DURING HEPATIC LOBECTOMY USING THE LIVER ISOLATION-PERFUSION TECHNIC. *(E.)* Howland, W. S.; Schweizer, O.; Fortner, J. G.; Shiu, M. H.; Ragasa, J. P.; Wightman, A. E.; Gould, P. (Memorial Sloan-Kettering Cancer Center, New York, N.Y. 10021). *Am. J. Surg.* 129(6):608-615, 1975.

7631 PRIMARY MALIGNANT LIVER TUMORS IN INFANCY AND CHILDHOOD. REPORT OF 12 CASES. *(E.)* Han Mao-t'ang; Fang Chic-ch'in; Ho Hui-chen; Fang Shih-hsun; Fang Tsung-chih; Sun Ts'ui-yun. (Tientsin Children's Hosp., Tientsin, China). *Chin. Med. J.* (11):194, 1974.

7632 SOME IMMUNOLOGICAL ASPECTS OF LIVER FUNCTION. *(E.)* Triger, D. R. (Univ. Southampton Medical Sch., Hampshire, England). *Yale J. Biol. Med.* 48:47-54, 1975.

See also, 6827, 6836, 6986, 6992, 7003, 7006, 7011, 7016, 7018, 7020, 7024, 7025, 7029, 7031, 7032, 7038, 7044, 7045, 7046, 7053, 7062, 7063, 7066, 7322, 7530, 7532, 7685, 7745, 7752, 7755, 7756, 7761, 7770, 7784, 7794, 7942, 7946, 7947, 7948, 7949, 7953, 7954, 7955, 7959, 7965, 7966, 7967, 7969.

## LIVER AND BILIARY TRACT

### Hyperbilirubinemic States

7633 NEONATAL HYPERBILIRUBINEMIA FOLLOWING THE USE OF OXYTOCIN IN LABOUR. *(E.)* Beazley, J. M.; Alderman, B. (Dept. Obstetrics Gynaecology, Univ. Liverpool, England). *Br. J. Obstet. Gynaecol.* 82(4):265-271, 1975.

A prospective study was made to determine the association of administration of oxytocin to women during labor and the subsequent occurrence of neonatal hyperbilirubinemia. Of 1393 consecutive patients initially studied, 40 were excluded because of the low birth weight (< 2.5 kg) of the babies. The remaining 1353 women were classified into three categories: 1) spontaneous labor (687); 2) spontaneous labor subsequently accelerated with oxytocin (149 of the first group); and 3) labor induced by forewater amniotomy and simultaneous i.v. oxytocin (666). No significant difference was seen in the mean bilirubin concentrations of infants born after induced or spontaneous labors. Women whose infants developed hyperbilirubinemia received a significantly higher mean total dose of oxytocin than women whose babies were not affected. In addition, the influence of oxytocin on subsequent hyperbilirubinemia was found to be dose-dependent. The incidence of the disease rose sharply when the total dose of the drug exceeded 20 U (12% of induced labors in this study). The incidence was also found to increase as the duration of induced labor increased. No similar relation was seen between the disease incidence and the duration of spontaneous labor. These results confirm that an association exists between the use of oxytocin in labor and neonatal hyperbilirubinemia. Low birth weight, duration of labor and method of feeding were eliminated as significant etiological factors.

7634 GROWTH HORMONE AND CORTISOL IN NEONATES DURING PHOTOTHERAPY. *(E.)* von Muhlendahl, K. E.; Ballowitz, L. (Univ. Kinderklinik, Freie Universitat, D-1000, Berlin 19, Heubnerweg 6, Germany). *Z. Kinderheilkd.* 119(1):53-58, 1975.

The effect of phototherapy on plasma growth hormone (GH) and cortisol levels in 22 neonates with hyperbilirubinemia was studied. GH values in healthy, full-term infants were elevated, as compared to older children and adults, during the entire neonatal period of this study. They demonstrated a slight rise on the second day, followed by a slow decline during the following days. Mean cortisol levels in these infants were lower than what would be expected as normal morning cortisol plasma concentrations in older children or adults. There was a lack of correlation between bilirubin and GH levels. There was also no correlation in the children subjected to phototherapy. Cortisol values were also unrelated to the degree of hyperbilirubinemia. During phototherapy most children had GH levels significantly higher than the healthy infants. There was also a significant difference in the levels during phototherapy and those recorded before or after treatment. This effect, however, was not seen in all children. In six neonates, GH failed to increase during therapy. Cortisol concentrations were not significantly higher

during treatment than before or after phototherapy. Differences between infants undergoing phototherapy and controls also were not significant. There was no correlation between GH and cortisol plasma levels. This study demonstrates that phototherapy in hyperbilirubinemic infants raises plasma GH concentrations, but does not alter cortisol levels. The mechanisms by which such treatment induces increases in GH are not evident. However, there might be some connection with the constant covering of the eyes, which abolishes the day-night rhythm, or other environmental alterations that are necessitated by the treatment apparatus.

7635 DUBIN-JOHNSON SYNDROME: A REPORT OF THE FIRST CASE AMONG CHILDREN THAT OCCURRED IN CUBA. *(Sp.)* Estrada Rodriguez, M.; Alverez Carrazana, L. (Prov. Pediatr. Hosp., Camaguey, Cuba). *Rev. Cubana Pediatr.* 46(6):627-636, 1974.

7636 ATYPICAL MITOCHONDRIA OBSERVED IN HEPATOCYTES OF ROTOR'S DISEASE. *(E.)* Kobayashi, T.; Fujita, K.; Yamada, G.; Kosaka, K. (Kawasaki Hosp., Okayama, Japan). *Nihon Ryneho Denshi Kenbikyo Gakkai-Shi* 7(3-4):357, 1974.

7637 INQUIRY INTO THE ETIOLOGY OF NEONATAL JAUNDICE IN ABIDJAN. *(Fr.)* Badoual, J.; Assi Adou, J.; Essoh Nomel, P.; Kangah, D. (Enquete sur l'etiologie des icteres du nouveau-ne`a Abidjan, Ivory Coast). *Ann. Pediatr.* 21(10):687-692, 1974.

See also, 7766.

## LIVER AND BILIARY TRACT

### Nonviral Hepatitis and Hepatic Injury

7638 ULTRASTRUCTURE OF THE LIVER IN HUMAN BRUCELLOSIS. *(Pol.)* Biczysko, W.; Juszczyk, J.; Blotna, M.; Kivzka, W. (Acad. Med., Poznan, Poland). *Pol. Arch. Med. Wewn.* 53(3):219-229, 1975.

Ultrastructural changes in liver of 25 patients with diagnosed brucellosis (one case in the acute stage, the rest with chronic disease), aged 33-65 yr, were studied by electron microscopy. The following were observed: in the acute stage of the disease, lysis of isolated liver cells, lymphocyte infiltrations in hepatic lobules, and epithelial cell infiltrates in the porto-biliary spaces; in the chronic stage, fatty infiltrations and bile stasis and signs of fibrosis of varying intensity were associated with lymphocyte infiltrations.

7639 ASPIRIN-INDUCED HEPATOTOXICITY IN JUVENILE RHEUMATOID ARTHRITIS: A PROSPECTIVE STUDY. *(E.)* Athreyz, B. H.; Moser, G.; Cecil, H. S.; Myers, A. R. (Children's Seashore House, 4100 Atlantic Ave., Atlantic City, N. J. 08401). *Arthritis and Rheumatism* 18(4):347-352, 1975.

In an effort to study salicylate-induced liver damage, a follow-up study was made of 42 children receiving aspirin therapy. Diagnoses in this patient population consisted of juvenile rheumatoid arthritis (34), acute cartilagenous necrosis of the hip following slipped capital femoral epiphysis (six), and ulcerative colitis and hip disease (two). The patients had received aspirin therapy over a period of one to 27 months. Serial determinations of SGOT, SGPT, lactic dehydrogenase, alkaline phosphatase, bilirubin, and serum salicylate were made. In 14 cases prothrombin time was measured. Twenty-two of the rheumatoid arthritis patients but none of the eight controls demonstrated abnormalities of various liver functions at serum salicylate levels between 7.0 and 43 mg%. Marked elevations of SGOT, SGPT, lactate dehydrogenase, and alkaline phosphatase were observed in three children who also demonstrated prolongation of prothrombin time and epistaxis. This type of reaction occurred within five to 14 days of the initiation of aspirin therapy. It occurred at serum salicylate levels between 18 and 43 mg%. In 19 other children, moderate changes in various liver function tests were noted. None of the other children showed prolongation of prothrombin time. The serum salicylate level in this group varied between 7.0 and 38.2 mg%. In six children, the liver function tests returned to normal after removal of the aspirin. In 12 others, the functions normalized even with continued aspirin therapy. The results of this study suggest that it is not necessary to discontinue salicylate therapy, except in those children who develop bleeding.

7640 ISONIAZID-ASSOCIATED HEPATITIS IN 114 PATIENTS. *(Eng.)* Black, M.; Mitchell, J. R.; Zimmerman, H. J.; Ishak, K. G.; Epler, G. R. (Nat. Heart and Lung Inst., Building 10, Room 8N-115, Bethesda, Md. 20014). *Gastroenterology* 69(2):289-302, 1975.

The nature of the apparent isoniazid-induced hepatic injury in 114 patients taking 300 mg of the drug daily for chemoprophylaxis of tuberculosis was studied. The clinical features in the 66 hospitalized patients consisted primarily of: gastrointestinal complaints in 55% of the cases, hepatomegaly with variable degrees of abdominal tenderness was present in 33% and jaundice was the presenting complaint in 10%. Marked hyperbilirubinemia was seen in 25% of the patients and was generally associated with a poor prognosis; alkaline phosphatase activity and the levels of SGOT

and SGPT were elevated in 92% of the patients in whom it was measured; prothrombin time values were abnormal in 20 of 54 patients; serum cholesterol levels were elevated in 29 of 48 and were below normal in five; and lactic dehydrogenase was elevated in 47 of 63 patients. Sections of hepatic tissue showed hepatocellular injury in 32 of 33 patients; the histologic pattern showed submassive necrosis in nine, massive necrosis in four, moderately severe acute hepatocellular injury in 16, and chronic hepatic disease in one. The inflammatory response in all these categories was similar, consisting mainly of lymphocytes and plasma cells with relatively few eosinophils and neutrophils. Most of the patients were between 40 and 60 years old, and hepatic injury was recognized in 15% during the first month of isoniazid administration, during the second month in 31%, and in 54% between the second and eleventh months. Thirteen of the 114 patients died. Hepatic injury presenting after 2 mo, especially with bilirubin levels exceeding 20 mg/100 ml, was more likely to have a fatal outcome than disease presenting during the first 2 mo, even with high bilirubin levels. The fatality rate was significantly higher in black females than in black males or in whites of either sex. The data offer no support for the view that isoniazid-induced hepatic disease results from hypersensitivity to the drug, but they do suggest that hepatotoxic metabolites of the drug may be responsible for the injury.

7641 ISONIAZID-ASSOCIATED HEPATITIS: RECONSIDERATION OF THE INDICATIONS FOR ADMINISTRATION OF ISONIAZID. *(E.)* Israel, H. L. (Jefferson Medical Coll., Philadelphia, Pa. 19107). *Gastroenterology* 69(2):539-542, 1975.

The use of isoniazid as a means of preventing activation of previously acquired tuberculosis infection has been advocated by public health physicians. This recommendation was carried out because isoniazid prophylaxis seemed effective, inexpensive, and safe. The discovery that isoniazid could induce liver damage has been met with slow acceptance among those working in the tuberculosis field. At a 1974 conference of the Tuberculosis Advisory Committee at the Center for Disease Control, it was concluded that the use of isoniazid as a preventative was justified regardless of patient age, despite a hepatitis risk of 2-3% over the age of 50, if the tuberculin reactor was a member of a household with recently diagnosed tuberculosis, had chest x-ray findings consistent with stable tuberculous lesions, had been recently infected, was receiving prolonged adrenocortico- or immunosuppressive therapy, or had leukemia, Hodgkin's disease, diabetes mellitus, silicosis, or a gastrectomy. A new and disturbing feature of studies dealing with hepatitis incidence among isoniazid users is the frequency of fatal hepatitis. Such findings have important implications for the further use of this medicine. An alternative approach in drug prophylaxis of tuberculosis would be the use of other chemotherapeutic agents. It is suggested that the use of isoniazid be restricted to patients with pulmonary and extrapulmonary tuberculosis in whom the diagnosis was confirmed by cultural demonstration of mycobacteria. Therapy for suspected tuberculosis is justified only in the critically ill. It is difficult to justify prophylactic use of a potentially fatal drug.

7642 LIVER DAMAGE THROUGH OXYPHENISATIN CONTAINING LAXATIVES. *(Fl.)* Bras, G.; Bronkhorst, F. B.; Haneveld, G. T.; Lourens, J. (Inst. Pathology, State Univ., Utrecht, The Netherlands). *Ned. Tijdschr. Geneeskd.* 117(40):1501-1504, 1973.

Chronic aggressive hepatitis with lobular involvement was diagnosed by clinical, biochemical, and histological examinations in a 67-yr-old female patient. The patient admitted to have taken an oxyphenisatin-containing laxative daily for about two years. Rapid normalization of the general health status and of the biochemical parameters after stopping the use of the drug was observed. The findings indicate the hepatotoxic effect of oxyphenisatin. For this reason, the sale of drugs containing oxyphenisatin has been banned in several countries.

7643 CHOLOSTATIC JAUNDICE FOLLOWING DISSEMINATED INTRAVASCULAR COAGULATION ("SHOCK-LIVER"). *(Ger.)* Kunzer, W.; Sutor, A. H.; Niederhoff, H.; Kunzer, Jr., W. (Univ. Freiberg, Child. Clin., Freiberg, Germany). *Klin. Wochenschr.* 53(9):441-443, 1975.

7644 THE FUNCTION OF THE HEPATO-BILIARY SYSTEM AFTER THE ACUTE INTOXICATION WITH POLYCHLOROPINENE. *(Rus.)* Bezugly, V. P.; Kaskevich, L. M.; Ovsiannikova, L. M. (Inst. Hygiene, Toxicology, Pesticides, Polymers, and Plastics, Kiev, USSR). *Gig. Tr. Prof. Zabol.* 19(2):52-54, 1975.

See also, 7002, 7308.

## LIVER AND BILIARY TRACT

### Acute Viral Hepatitis

7645 FUNCTIONAL SULFOBROMOPHTHALEIN TEST IN THE EVALUATION OF SHORT-TERM OUTCOME OF VIRAL HEPATITIS. *(Rus.)* Sorinson, S. N.; Kuksenkov, E. S. (S. M. Kirov Medical Inst., Gorky, USSR). *Ter. Arkh.* 46(4):68-71, 1974.

A BSP test was used for the determination and characterization of phenomena following viral hepatitis. The study was performed on 204 patients with viral hepatitis (172 cases of infectious, and 32 cases of serum hepatitis), 25 patients with primary hyperbilirubinemia,

seven patients with chronic hepatitis, and a control group of ten persons. The ages of patients varied between 20 and 60 yr. BSP was introduced i.v. (5 mg/kg); its content in the blood of the patients was determined spectrophotometrically with samples taken 3 and 45 min after the i.v. introduction; in urine, samples were taken 2, 4, and 6 hr after i.v. introduction. Results showed very definitely that in proportion to the weakening of jaundice and in the post-jaundice period for the majority of patients, the indexes of the BSP test showed significant changes. The following percentages of the retained BSP in the blood were retained for each particular group of patients: for patients with no signs of hepatitis, 4.6%; for patients with post-hepatic bilirubinemia, 3.2%; for patients with hepatomegaly, 7.0%; for patients with dyscrasia of the bile ducts, 12.3%; and for patients with noncurable hepatitis, 21.1%. The results of urine analysis showed just the opposite behavior; in proportion to the dissipation of the signs of jaundice, the content of BSP excreted in the urine decreased.

7646 THE DETECTION OF HEPATITIS B ANTIGEN IN HEPATIC PARENCHYMA BY THE FLUORESCENT ANTIBODY TECHNIC. *(E.)* Orr, W. (Dept. Pathology, Univ. Manitoba, 770 Bannatyne Ave., Winnipeg 3, Manitoba, Canada). *Am. J. Clin. Pathol.* 64(2):257-262, 1975.

The fluorescent antibody technique was applied to the detection of hepatitis B antigen (HBAg) in 42 specimens of liver tissue from patients with a variety of liver diseases. Twelve of the 42 samples were from HBAg-seropositive patients whose diagnoses included acute viral hepatitis (seven), chronic persistent hepatitis (one), chronic aggressive hepatitis (two), cryptogenic cirrhosis (one), and hemosiderosis (one). The other 30 tissue samples were from HBAg-seronegative patients diagnosed as having acute viral hepatitis (five), chronic persistent hepatitis (three), chronic aggressive hepatitis (two), primary biliary cirrhosis (two), cryptogenic cirrhosis (two), alcoholic hepatitis (three), alcoholic cirrhosis (three), normal liver (two), hemosiderosis (one), secondary biliary cirrhosis (one), intrahepatic biliary atresia (one), idiopathic recurrent cholestasis (one), Wilson's disease (one), extrahepatic biliary obstruction (one), nonspecific reactive hepatitis (one), and passive congestion (one). In four seropositive patients, fluorescence was cytoplasmic in location when stained with commercial rabbit antisera. Nuclear fluorescence was noted in one case reexamined with a human antiserum. In these patients, round intranuclear virus-like particles with a slightly angular profile, measuring about 20 mm in diameter, were found by electron microscopy. These patients all had chronic aggressive hepatitis or active cirrhosis, and all were receiving immunosuppressive therapy. This study has shown an inverse relation between the intensity of liver-cell injury and the presence of HBAg or nuclear particles in hepatic parenchymal cells in HBAg-seropositive patients. These data are consistent with the hypothesis that viral hepatitis B represents a cellular immunologic attack on viruses and on liver cells that have been altered by the incorporation of viral antigens into their cell membranes. When competent, the immune response eliminates both types of attack, and acute viral hepatitis results. When the immune response is deficient or suppressed, the outcome is chronic hepatitis.

7647 HEPATITIS B SURFACE ANTIGEN ($HB_SAg$) SUBTYPES AND INDICES OF CLINICAL DISEASE. *(E.)* Gerety, R. J.; Hoofnagle, J. H.; Nortman, D. F.; Barker, L. F. (Bureau Biologics, Food Drug Admin., 8800 Rockville Pike, Bethesda, Md. 20014). *Gastroenterology* 68(5):1253-1260, 1975.

The possibility that infection with different subtypes of the hepatitis B surface antigen ($HB_SAg$) may result in cases of hepatitis with different clinical features and outcomes was investigated. Of 190 patients exposed to a common icterogenic plasma pool or one of its infectious derivatives, 111 developed $HB_SAg$ detectable by radioimmunoassay, 75 of which circulated $HB_SAg$ detectable by counterelectrophoresis. Of these, 74 could be subtyped by counterelectrophoresis, rheophoresis, or agar gel diffusion. Of these, 50 were subtype *adw*, 22 *ayw*, and two were *adyw* (these last were excluded from study). The incubation period was shorter among *adw* than *ayw* cases by an average of 10-12 days. These differences were highly significant ($P < 0.05$) only for incubation period as measured from the date of exposure to the plasma pool to the measurement of $HB_SAg$ appearance by both radioimmunoassay and counterelectrophoresis. For most disease indices, *adw* cases appeared to be more severe, but there was considerable overlap between the two groups, the average differences were small, and there was no significant difference between them. The chronic carrier state developed in 16.0% of *adw* cases and in 9.1% of *ayw* cases, which was not significantly different. No statistically significant difference was seen between *adw* and *ayw* cases for any index of residual disease analyzed. These data indicate that $HB_SAg$ subtypes *d* and *y* do not correlate with the clinical manifestations or outcome of hepatitis B virus infection.

7648 HEPATITIS B SURFACE ANTIGEN IN SALIVA OF $HB_SAg$ CARRIERS. *(E.)* Feinman, S. V.; Krassnitski, O.; Sinclair, J. C.; Wrobel, D. M.; Berris, B. (Mount Sinai Hosp., Univ. Toronto, Canada). *J. Lab. Clin. Med.* 85(6):1042-1048, 1975.

Saliva from a large number of adult asymptomatic hepatitis B surface antigen ($HB_SAg$) carriers and normal controls was tested for the presence of $HB_SAg$. Several techniques were used to study 212 saliva specimens from 112 carriers. Crossover immunoelectrophoresis with four different antisera and normal human plasma was used to test 66 specimens from 63 carriers. Radioimmunoassay after dialysis and concentration against polyvinyl pyrolidine was used to test 58 of these (Group A). Radioimmunoassay after passage through a Celite filter, followed by dialysis and 60x concentration against polyvinyl pyrolidine, was used with 87 samples from 60 carriers (Group B). The presence of the antigen in 59 saliva samples from 51 carriers was investigated by radioimmunoassay after passage through a Celite filter and 30x concentration against polyethylene glycol (Group C).

These samples were also tested by crossover immunoelectrophoresis using only one antiserum. The last group (Group D) included 44 samples from 44 antigen- and antibody-negative controls, applying the same methods as used for Group C. Crossover immunoelectrophoresis detected $HB_sAg$ in 66 samples from Group A (6%) and 59 from Group C (16%). Radioimmunoassay detected the antigen in 37% of samples from Group A, 16% of Group B (87 specimens), and in 78% of Group C samples. Of six saliva specimens collected at different times from one antigen carrier, but processed and tested the same way (Group B), two were positive and four were negative for the antigen. It is suggested that the presence of $HB_sAg$ in saliva may indicate that saliva is important in the spread of infection.

7649 CELL-MEDIATED IMMUNITY TO HEPATITIS B SURFACE ANTIGEN IN BLOOD DONORS WITH PERSISTENT ANTIGENAEMIA. *(E.)* Lee, W. M.; Reed, W. D.; Mitchell, C. G.; Woolf, I. L.; Dymock, I. W.; Eddleston, A. L. W. F.; Williams, R. (King's Coll. Hosp. Med. Sch., London, England). *Gut* 16(6):416-420, 1975.

Cellular immunity to the hepatitis B surface antigen ($HB_sAg$) was examined in blood donors who were carriers of the antigen, some with liver biopsy abnormalities of varying severity, using the leukocyte migration test. The subjects were also tested for sensitization to the liver-specific membrane lipoprotein. All 38 subjects had $HB_sAg$ detectable in serum by immunodiffusion or electrophoresis, and all were asymptomatic. Elevated serum aspartate aminotransferase levels were found in 15, ranging from 44-247 IU/liter. Liver biopsies were performed in 10 of the 38 and in seven of the 15 with abnormal enzyme levels. Inhibition of leukocyte migration with $HB_sAg$ was found in 10 (26%) of the 38. Of 23 cases with normal enzyme levels, only three (13%) showed migration inhibition, while inhibition of migration was present in seven (47%) of the 15 with abnormal enzyme levels. This difference was statistically significant. Of nine cases with unrelated changes or focal necrosis on liver biopsy, only one (11%) showed cellular immunity to $HB_sAg$, compared with three (38%) of eight cases with chronic persistent or chronic aggressive hepatitis. Inhibition of migration by the liver-specific lipoprotein was seen in seven (78%) of nine tested patients with abnormal enzyme levels, in none of seven with normal enzyme levels, and in six (75%) of eight with hepatitis. Two subjects with unrelated histological changes had normal migration indices, and only one of four with focal parenchymal necrosis showed lipoprotein sensitization. This study supports the hypothesis that a T-lymphocyte response to $HB_sAg$ can initiate an autoimmune reaction to liver-specific lipoprotein, and that this reaction may be of importance in the pathogenesis of liver damage. In the absence of the T-cell response, there would be no autoimmune reaction and no liver damage.

7650 CELL-MEDIATED IMMUNE REACTIVITY TO HEPATITIS B SURFACE ANTIGEN IN LIVER DISEASE. *(E.)* De Moura, M. C.; Vernace, S. J.; Paronetto, F. (Mount Sinai Sch. Medicine, City Univ. New York, New York, N. Y). *Gastroenterology* 69(2): 310-317, 1975.

Using a purified preparation of hepatitis B surface antigen ($HB_sAg$) and the leucocyte migration agarose test, the cellular immune reactivity to $HB_sAg$ was studied in 57 patients with liver diseases. The patient population included nine patients with $HB_sAg$-positive acute viral hepatitis (AVH), five recovering from $HB_sAg$-positive AVH, 27 with chronic hepatitis and 21 patients with miscellaneous liver diseases including alcoholic cirrhosis (11), primary biliary cirrhosis (four), extrahepatic biliary obstruction (four), drug-induced hepatitis (one) and recurrent benign cholestasis (one). In all nine patients in the acute phase of viral hepatitis, inhibition of leucocyte migration by $HB_sAg$ was noted. This was not found during convalescence. In only one of 15 patients with chronic persistent hepatitis did $HB_sAg$ inhibit migration of leukocytes. Such inhibition was not noted in any of the 16 with chronic periportal hepatitis, and in only two of 21 with nonhepatic liver diseases. In a group of 16 normal patients studied as controls, inhibition of migration was found in only one, a physician, exposed to $HB_sAg$. Using $HB_sAg$-positive serum as antigen gave similar, but not identical, results. No correlation could be determined between reactivity to $HB_sAg$ and the presence of autoantibodies or anti-$HB_s$ in patients with chronic hepatitis. This study suggests that a reactivity to $HB_sAg$ in patients with acute viral hepatitis may indicate clearing of the antigen, whereas in patients with chronic hepatitis it may reflect a state of specific tolerance to this antigen. Additional studies using other preparations of antigens associated with hepatitis B virus are needed to clarify the role of cell-mediated immunity to hepatitis B virus in acute and chronic liver diseases.

7651 TREATMENT OF ACUTE LIVER FAILURE DUE TO HEPATITIS B (HB) VIRUS WITH PLASMA CONTAINING ANTIBODIES FOR HB. *(Ger.)* Bolte, J. P.; Meyer zum Buschenfelde, K. H.; Knolle, J. (2nd Med. Clin., Johannes Gutenberg Univ., Mainz, Germany). *Inn. Med.* 1(2):63-72, 1974.

Case reports are presented for six patients (four women and two men, aged 22-49 yr) with HBAg-positive hepatitis and hepatic coma (four in stage IV and two in stage II) who were treated with plasma containing antibodies for HB (HBAb: 2-7 doses of 150-200 ml over 1-4 days) in combination with large doses of hydrocortisone (200-300 mg/day in five cases; 1200 mg/day in one case). Of these six patients, four recovered and became HBAg-negative and two women died. One was a 49-yr-old patient who had taken a laxative containing 5 mg diacetyldiphenolisatin every day. She died of circulatory failure; two bleeding gastric ulcers were found at autopsy. The other patient who died was 9 months pregnant and developed intestinal bleeding with terminal intravascular clotting. To be effective, plasma containing HBAg must be administered early. To obtain more information about the effectiveness of treating fulminating liver failure with plasma containing HBAb and corticosteroids, a

controlled study must be performed using large doses of cortisone alone.

7652 SERUM IMMUNOGLOBULIN CONTENT IN INFECTIOUS AND SERUM HEPATITIS. *(Rus.)* Cherednichenko, T. V.; Petrunin, Y. A. (N. I. Pirogov 2nd Moscow Medical Inst., USSR). *Vopr. Okhr. Materin. Det.* 20(3):11-14, 1975.

7653 SERUM PROTEIN SPECTRUM ACCORDING TO DATA FROM POLYACRYLAMIDE GEL DISC-ELECTROPHORESIS IN CHILDREN WITH VIRAL HEPATITIS. *(Rus.)* Bragin, V. P. (Leningrad Medical Inst. Sanitation Hygiene, USSR). *Vopr. Okhr. Materin. Det.* 20(3):7-11, 1975.

7654 VIRAL HEPATITIS. REPORT OF A WHO MEETING. *(E.)* Anonymous. (World Health Organization). *Geneva, World Health Organization*, 1975, 49 pp.

7655 ADVANCES IN HEPATITIS B-ASSOCIATED ANTIGEN (HB Ag). *(Fr.)* Soulier, J. P. (No affiliation given). *Rev. Fr. Gastroenterol.* (102):23-24, 27-28, 32, 1974.

7656 FREQUENCY OF AUSTRALIA ANTIGEN IN SOME ACUTE AND CHRONIC LIVER DISEASES. *(It.)* Perpignano, G.; Demelia, L.; Argiolas, N. (Istituto di Patologia Speciale Medica, Univ. di Cagliari, Cagliari, Italy). *Rass. Med. Sarda* 26(2):169-177, 1974.

7657 EDEMATOUS HEPATITIS: A SPECIAL FORM OF ACUTE VIRUS HEPATITIS WITH SECONDARY ALDOSTERONISM. *(Ger.)* Kuntz, E. (Medizinische Klinik II, Kreis- und Stadtkrankenhaus, Wetzlar, Germany). *Med. Klin. (Mosk)* 70(7):274-278, 1975.

7658 GAMMA-GLUTAMYL TRANSPEPTIDASE, MOST SENSIBLE INDICATOR FOR THE ASSESSMENT OF COMPLETE CURE OF ACUTE VIRUS HEPATITIS? *(Ger.)* Eisenberg, K.; Ortmans, H. (Medizinische Klinik I und Zentrallaboratorium des Stadtkrankenhauses Kassel, Germany). *Med. Klin. (Mosk)* 70(7):270-273, 1975.

7659 SERUM LIPIDES AND SERUM LIPOPROTEINS IN LIVER DISEASES. *(Ger.)* Greiner, S.; Weinbeck, M.; Englhardt, A. (Medizinische Klinik der Universitat, Marburg/Lahn, Germany). *Med. Klin. (Mosk)* 70(6):231-241, 1975.

7660 CONSECUTIVE DISEASES AFTER INFECTIOUS HEPATITIS. *(Ger.)* Morl, M. (Medizinischen Klinik der Universitat Erlangen-Nurnberg, Nurnberg, Germany). *Fortschr. Med.* 93(2):49-51, 1975.

7661 CONDITIONS FOLLOWING VIRUS HEPATITIS. *(Cz.)* Cervenka, J.; Zacharova, M.; Ottis, V. (Odboru epidemiologie Vyskumneho ustavu epidemiologie a mikrobiologie, Palisady 47, 881 27 Bratislava, Czechoslovakia). *Bratisl. Lek. Listy* 63(4):482-488, 1975.

7662 EPIDEMIOLOGICAL COMPARATIVE STUDIES OF AUSTRALIA ANTIGEN AND ENZYME SCREENING TEST RESULTS CARRIED OUT IN FAMILIES. *(Ger.)* Beck, R.; Puschel, J.; Friedemann, H.; Tacke, A.; Geserick, G.; Anton, I.; Neumann, A. (Hygiene-Inspektion, 1058 Berlin, Germany). *Z. Gesamte Hyg.* 20(9):601-605, 1975.

7663 ON THE EFFECTIVENESS OF GAMMA GLOBULIN PROPHYLAXIS IN FAMILIES DURING INFECTIOUS HEPATITIS INCUBATION SUBJECTED TO ENZYME SCREENING TEST CONTROL. *(Ger.)* Beck, R.; Puschel, J.; Friedemann, H.; Neumann, A.; Redlich, V. (Hygiene-Inspektion, 1058 Berlin, Germany). *Z. Gesamte Hyg.* 20(9):605-607, 1974.

7664 INVESTIGATIONS ON THE PRESENCE OF HEPATITIS ANTIGEN AND OF THE HOMOLOGOUS ANTIBODIES IN VETERINARIANS AND WORKERS ATTENDING TO ANIMALS. *(E.)* Surdan, C.; Cruceanu, A.; Babes, V. T.; Milcov, V.; Sorodoc, G.; Cajal, St. ("Stefan S. Nicolau" Inst. Virology, Bucharest, Romania). *Rev. Roum. Virol.* 25(4):343-345, 1974.

7665 THE INCIDENCE OF HEPATITIS WITH HB Ag AMONG THE MEDICO-SANITARY PERSONNEL. *(E.)* Bals, M. G.; Bocarnea, C.; Caruntu, Fl.; Duminica, A.; Angelescu, C.; Hagiescu, L.; Toma, E.; Tudose, M. (Colentina Hosp., Bucharest, Romania). *Rev. Roum. Virol.* 25(4):365, 1974.

7666 TECHNIQUE FOR THE VISUALIZATION OF PRECIPITATION BANDS OBTAINED BY GEL IMMUNODIFFUSION REACTIONS FOR HEPATITIS B ANTIGEN DETECTION. *(E.)* Cruceanu, A.; Babes, V. T. ("Stefan S. Nicolau" Inst. Virology, Bucharest, Romania). *Rev. Roum. Virol.* 25(4):303-308, 1974.

7667 IMMUNOFLUORESCENT DETECTION OF HEPATITIS B ANTIGEN IN PARAFFIN-EMBEDDED LIVER TISSUE. *(E.)* Ray, M. B.; Desmet, V. J. (Dept. Medische Navorsing, B 3000 Leuven, Belgium). *J. Immunol. Methods* 6(3):283-289, 1975.

7668 CLINICAL COURSE OF VIRAL HEPATITIS. *(E.)* Wewalka, F. (no affiliation given). *Clin. Gastroenterol.* 3(2):355-376, 1974.

7669 THE LABORATORY IN THE DIAGNOSIS AND MANAGEMENT OF VIRAL HEPATITIS. *(E.)* McIntyre, N.; Heathcote, J. (no affiliation given). *Clin. Gastroenterol.* 3(2):317-336, 1974.

7670 IMMUNE RESPONSE IN ACUTE VIRAL HEPATITIS. *(E.)* Berg, P. A. (no affiliation given). *Clin. Gastroenterol.* 3(2):255-275, 1974.

7671 PROPHYLAXIS OF VIRAL HEPATITIS. *(E.)* Kaboth, U.; Junge, U. (no affiliation given). *Clin. Gastroenterol.* 3(2):453-470, 1974.

7672 EPIDEMIOLOGY OF SERUM HEPATITIS. *(E.)* Ringertz, O. (no affiliation given). *Clin. Gastroenterol.* 3(2):305-316, 1974.

7673 EPIDEMIOLOGY OF INFECTIOUS HEPATITIS. *(E.)* Krejs, G. J.; Gassner, M.; Blum, A. L. (no affiliation given). *Clin. Gastroenterol.* 3(2):277-03, 1974.

7674 THE VIRUSES OF HEPATITIS. *(E.)* Waterson, A. P. (no affiliation given). *Clin. Gastroenterol.* 3(2):241-254, 1974.

7675 POSTHEPATITIS SYNDROMES. *(E.)* Martini, G. A.; Stronheyer, G. (no affiliation given). *Clin. Gastroenterol.* 3(2):377-390, 1974.

7676 VIRAL HEPATITIS IN INFANCY AND CHILDHOOD. *(E.)* Rotthauwe, H. W. (no affiliation given). *Clin. Gastroenterol.* 3(2):437-452, 1974.

See also, 7596, 7619, 7640, 7697, 7720, 7730, 7895.

## LIVER AND BILIARY TRACT

### Chronic Hepatitis

7677 ELECTRON MICROSCOPIC OBSERVATIONS ON CHRONIC AGGRESSIVE HEPATITIS: PARTICIPATION OF HEPATOCYTES IN LIVER FIBROSIS. *(E.)* Groniowski, J.; Walski, M. (Inst. Biostructure, Chalubinskiego 5, Warsaw, Poland). *Pathol. Eur.* 10(1):37-50, 1975.

The progressive fibrosis of the liver parenchyma which occurs in chronic aggressive hepatitis was studied in seven cases of clinically diagnosed and histologically proven chronic aggressive hepatitis. Needle biopsy specimens of the liver were examined by light and electron microscopy. Newly formed collagen fibrils were deposited in the Disse spaces and in the widened intercellular spaces. In four cases, collagen fibrils were also observed intracellularly inside single hepatocytes; the fibrils were usually located in the central part of the cell where they formed small bundles with no surrounding membrane. Deep infoldings of the plasma membrane containing some clusters of fibrils were often found, but the possibility of invagination of collagen fibrils from the outside was ruled out. In two other cases, the hyaloplasm of the hepatocytes occasionally contained randomly distributed crystalline structures which were unrelated to the cell organelles. These structures appeared to be made up of aggregates of protein molecules. The coincidence of crystalloids in the mitochondrial matrix and crystalline structures in the hyaloplasm of the hepatocytes was noted in one case. Hepatocytes containing the crystalline and/or filamentous structures were otherwise of normal or nearly normal appearance. The presence of collagen fibrils in the hyaloplasm of the hepatocytes tentatively suggests that these cells may participate in collagen biosynthesis in the course of chronic aggressive hepatitis. The data indicate that in some pathological conditions, the production of fibrous collagen is not the exclusive function of the mesenchymal fibroblastic cells.

7678 CHRONIC PERSISTENT HEPATITIS. A CLINICAL, SEROLOGICAL, AND PROGNOSTIC STUDY. *(E.)* Dietrichson, O. (Kommunehospitalet, DK-1399, Copenhagen K, Denmark). *Scand. J. Gastroenterol.* 10(3): 249-255, 1975.

The incidence and degree of different clinical, biochemical, and immunological variables are described in a consecutive series of 26 patients with chronic persistent hepatitis. These included 16 males and 10 females, aged 10 to more than 50-yr, with most patients falling in the 20 to 29-yr-old range. The onset of disease was acute in 22 cases (84.6%). The average time from admission to diagnosis of chronic persistent hepatitis was 13.2 months. Of three patients with a history of high oxyphenasitin intake, two were challenged with the drug, and the challenge produced a significant increase in liver function parameters in one. Physical examination showed spider naevi in two cases, one of whom also had palmar erythema. Only three patients had elevated serum bilirubin values. Alkaline phosphatases were increased in six cases. Immunoglobulin G was elevated in approximately 50% of patients. Australian antigen was demonstrated in the sera of 12 patients (46%). Follow-up studies included one or more repeat biopsies in 16 patients, and clinical and biochemical follow-ups in all 26 patients. In three cases, the last repeat biopsy showed progression to cirrhosis, severe portal fibrosis, and chronic aggressive hepatitis. Of 26 patients, 17 were completely well without evidence of liver disease. It is recommended that the course of disease be followed in patients with chronic persistent hepatitis to reveal the few cases which progress to active liver disease.

7679 DIAGNOSIS, THERAPY AND CLINICAL COURSE IN CHRONIC ACTIVE HEPATITIS IN CHILDHOOD WITH SPECIAL REFERENCE TO IMMUNOLOGICAL FINDINGS. *(Ger.)* Baumann, W. (Univ. Clin. Pediatr., Mainz, Germany). *Monatsschr. Kinderheilkd.* 122(12):904-913, 1974.

The cases of nine patients with chronic active hepatitis (aged 1.3-16.9 yr) are evaluated and pathogenetic implications of humoral and cellular autoimmune

phenomena and of the Australia antigen ($HB_SAg$) are discussed. Follow-up examinations covered between 11 months and 6.10 yr. The diagnosis was based on chronicity of the hepatopathy at least over several months and a tendency to exacerbation, hepatosplenomegaly, persistently increased transaminase activity, hypergammaglobulinemia, pathological humoral and cellular immune response, and morphological signs of chronic aggressive hepatitis. In contrast to published data concerning adult patients, children with $HB_SAg$-positive tests showed humoral and cellular immune disturbances, as did a considerable percentage of the $HB_SAg$-negative children. A nonparenteral route of infection was postulated for one of the $HB_SAg$-positive cases since $HB_SAg$ could be detected in three related persons. Simultaneous manifestation of chronic active hepatitis and persistence of $HB_SAg$ in a certain family may indicate a hereditary genetic aberration or immune defect. Furthermore, based on an observation reported here, attention is drawn to the possibility of drug-induced chronic active hepatitis: three children were treated with azathioprine in combination with small doses of glucocorticosteroids, and four received glucocorticosteroids only. It is concluded that in selected cases, an immunosuppressive regimen is preferred with regard to frequency of relapses, cirrhotic transformation and side effects. Analysis of transaminases, γ-globulins, humoral and cellular immune response, and morphological examination of liver tissue are adequate tools for follow-up.

7680 IMMUNOLOGICAL STUDIES IN PATIENTS WITH CHRONIC ACTIVE HEPATITIS: CYTOTOXIC ACTIVITY OF LYMPHOCYTES TO AUTOCHTHONOUS LIVER CELLS GROWN IN TISSUE CULTURE. *(E.)* Paronetto, F.; Vernace, S. (Veterans Admin. Hosp., 130 W. Kingsbridge Road, Bronx, N.Y. 10468). *Clin. Exp. Immunol.* 19(1):99-104, 1975.

The cytotoxic activity of lymphocytes against autochthonous liver cells grown in tissue culture was studied, to determine whether a cell-mediated immune process plays a role in the pathogenesis of some liver diseases. Cells were taken from 26 patients with chronic active and chronic persistent hepatitis, acute viral hepatitis, miscellaneous liver diseases, and patients without histological evidence of liver disease. Cytotoxic activity of lymphocytes against autochthonous liver cells was displayed in one patient with primary biliary cirrhosis, eight of 10 cases of chronic active hepatitis, and two patients with chronic persistent hepatitis. Of 12 patients with chronic persistent or chronic active hepatitis, six had hepatitis B antigen (HBAg) detected in serum by double antibody radioimmunoassay. Lymphocytotoxicity was seen with equal incidence (five of six patients) in both HBAg-positive and HBAg-negative cases. Lack of cytotoxicity was associated with steroids or azathioprine treatment. Lymphocytotoxicity was also seen in three of five patients with HBAg-positive acute viral hepatitis. In the group with miscellaneous liver diseases, only one patient (with alcoholic hepatitis and pancreatic carcinoma) exhibited reactivity of lymphocytes against autochthonous liver cells. Phytohemagglutinin-induced lymphocytotoxicity was studied in all patients. Smooth muscle antibodies were detected in two cases with chronic active hepatitis. Nuclear antibodies were seen in one case of acute viral hepatitis, and mitochondrial antibodies were seen in the patient with primary biliary cirrhosis. These results indicate *in vitro* reactivity of patient lymphocytes with some liver diseases, and support the suggestion that an *in vivo* aggressive activity of lymphocytes against liver cells plays a role in the pathogenesis of some liver diseases.

7681 ANTIBODIES TO DOUBLE-STRANDED (NATIVE) DNA IN ACTIVE CHRONIC HEPATITIS. *(E.)* Davis, P.; Read, A. E. (Dept. Medicine, Univ. Bristol, England). *Gut* 16(6):413-415, 1975.

The presence of double-stranded DNA antibodies was investigated in systemic lupus erythematosus and chronic active hepatitis. Sera from 36 patients with chronic active hepatitis were compared with sera from patients with systemic lupus erythematosus. Sera were also tested from patients with other liver diseases, including primary biliary cirrhosis, alcoholic cirrhosis, and acute viral hepatitis. A modification of the Farr test was used for the detection of antibody to DNA antigens. The normal range for DNA binding was 0-30% (mean 11%) calculated from sera of 200 normal controls. Of 36 hepatitis patients, 17 (47%) had levels of DNA binding in the range (0-50%, mean 26%) previously reported only in active cases of systemic lupus erythematosus. None of the patients with other liver diseases had DNA antibody levels outside the normal range (mean 12%). All chronic active hepatitis patients with significantly elevated DNA antibodies had positive antinuclear antibody, and in all five in whom it was measured, smooth muscle antibody was found. DNA binding ranged from 0-93% (mean 40%) in patients with active and inactive systemic lupus erythematosus. These preliminary studies suggest that detection of antibodies to double-stranded DNA may be of future value in the study of chronic active hepatitis.

7682 LYMPHOCYTE CYTOTOXICITY TO AUTOLOGOUS LIVER CELLS IN CHRONIC ACTIVE HEPATITIS. *(E.)* Wands, J. R.; Isselbacher, K. J. (Harvard Medical Sch., Boston, Mass. 02114). *Proc. Natl. Acad. Sci. USA* 72(4):1301-1303, 1975.

The effect of prednisone therapy *in vivo* on lymphocyte cytotoxicity toward Chang liver cells and *in vitro* toward autologous liver cells was investigated. Cells were obtained at biopsy from nine patients with chronic active hepatitis and three patients with chronic persistent hepatitis. Peripheral lymphocytes from patients with chronic active hepatitis were spontaneously cytotoxic to human Chang liver cells when tested at a lymphocyte:target cell ratio of 200:1. The mean spontaneous lymphocytotoxicity in patients with chronic active hepatitis was 9.6% compared with 3.6% in normal controls. There was no difference in concanavalin A (10 μg/ml) maximally stimulated cytotoxicity between patient and control lymphocytes. Patient lymphocytes were markedly cytotoxic to autologous liver cells (26.1%) compared with controls (2.7%). Patient lymphocytes

were more cytotoxic toward autologous liver cells than to the Chang liver cell line. Chronic prednisone administration (30-60 mg/day for a mean of 2.5 months) in five patients with chronic active hepatitis in clinical remission markedly inhibited both spontaneous and concanavalin A-stimulated lymphocytotoxicity to Chang liver cells. Spontaneous lymphocytotoxicity decreased from 9.6% to 2.8%, and concanavalin A-stimulated cytotoxicity from 36.0% to 7.4% with prednisone therapy ($P < 0.005$). Prednisone therapy *in vivo* diminished lymphocytotoxicity *in vitro* toward autologous liver cells. These results show that prednisone treatment of patients with chronic active hepatitis results in a marked inhibition of the effector cytolytic phase of cell-mediated immunity.

7683 DEMONSTRATION OF SMOOTH MUSCLE CONTRACTILE PROTEIN ANTIGENS IN LIVER AND EPITHELIAL CELLS. *(E.)* Holborow, E. J.; Trenchev, P. S.; Dorling, J.; Webb, J. (Canadian Red Cross Memorial Hosp., Taplow, Maidenhead, Berkshire, England). *Ann. N.Y. Acad. Sci.* 254:489-504, 1975.

Immunofluorescence and immunoperoxidase labeling were used to study the distribution of the different contractile smooth muscle-type proteins in tissues other than smooth muscle with antisera raised against the different proteins. Myosin, actin, tropomyosin, and heavy meromyosin were purified from uterus specimens, and antisera to these proteins raised in rabbits. Rat and guinea pig liver sections and rat stomach, duodenal, and kidney sections were stained and examined under the light and immunoelectron microscopes. By light microscopy, the antisera against all four proteins displayed polygonal staining patterns similar to those revealed by immunofluorescence with the same sera. Serum from a patient with neuroblastoma showed a similar but more marked staining, which appeared to delineate the biliary canaliculi. Immunoelectron microscope results with the peroxidase reagent showed that antiactin was reacting with a submembranous region of the guinea pig liver cell. In addition, staining was especially localized around the tight junctions of biliary canaliculi. Filaments were seen in some areas, although the morphologic characteristics of the staining were not well defined. Submembranous and tight junction regions of liver cells and biliary canaliculi were similarly stained with neuroblastoma serum. Apical staining by both the immunofluorescence and immunoperoxidase methods was seen in cells of the gastric and duodenal mucosa and the renal tubular epithelium. Antiheavy meromyosin serum produced a bile duct staining pattern. The electron microscope showed apical staining of duodenal epithelial cells with antiheavy meromyosin and antiactin, involving a band of filaments just below the villi of each cell. Neuroblastoma serum stained gastric, duodenal, and renal tubular cells similarly to the staining in liver. These results provide immunologic evidence of the presence of actin and heavy meromyosin in submembranous liver cells and in gastrointestinal and kidney epithelium, all of which are important sites of endocytosis and the release of secretions based on cell membrane movement. These two smooth muscle proteins also appear to be involved in the cell-to-cell adhesion mechanisms operating at tight junctions.

7684 GLUCOCORTICOIDS IN CHRONIC LIVER DISEASE. *(Ger.)* Maier, K. P.; Talke, H.; Gerok, W. (Med. Clin., Univ. Freiburg/Breisgau, Germany). *Dtsch. Med. Wochenschr.* 100(11):560-563, 1975.

Since there is no proof that glucocorticoids shorten the course of acute hepatitis or prevent it from becoming chronic, their use cannot be justified except for patients in hepatic coma. Some investigators report that glucocorticoids increase survival in patients with chronic aggressive hepatitis, but conflicting results have been obtained about whether they induce clinical, biochemical, and histological remissions. Discontinuation of therapy often results in recurrences. Glucocorticoids are not indicated for treatment of chronic persistent hepatitis because of its benign course and the serious side-effects these drugs can produce. In a small controlled study, glucocorticoids increased survival from 15% to 62% in cirrhosis, but a larger study found no significant difference between the survival of treated patients and untreated controls. In the latter study, the only group of patients benefiting from therapy was nonalcoholic women with no ascites; males with ascites had significantly shorter survival times than untreated controls. There is no evidence that glucocorticoids lengthen survival in patients with alcoholic steatosis or alcoholic hepatitis.

7685 TESTS RELATED TO COPPER METABOLISM: ABNORMALITIES IN CHRONIC ACTIVE LIVER DISEASE (CALD). *(E.)* LaRusso, N. F.; Summerskill, W. H. J.; McCall, J. T. (Mayo Clin., Rochester, Minn.). *Gastroenterology* 68(4):993, 1975.

7686 FURTHER STUDIES ON THE CYTOTOXIC ACTIVITY OF LYMPHOCYTES AGAINST LIVER CELLS IN PATIENTS WITH CHRONIC HEPATITIS (CH). *(E.)* Paronetto, F.; Vernace, S. J.; Colombo, M. (VA Hosp., Bronx, N.Y.). *Gastroenterology* 68(4):965, 1975.

7687 ANTIGLOMERULAR ANTIBODY (AGA) AS A DIAGNOSTIC TOOL FOR THE CIRRHOTIC STAGE OF CHRONIC ACTIVE HEPATITIS (CAH). *(E.)* Lopes, J. D.; Camargo, M. E.; Pontes, J. F.; Raia, S.; Da Silva, L. C. (Inst. Med. Trop. Ibepege, Sao Paulo, Brazil). *Gastroenterology* 68(4):938, 1975.

7688 DISTURBANCES OF ALBUMIN METABOLISM IN CHRONIC CHOLESTATIC HEPATITIS. *(Rus.)* Vinogradov, V. F.; Podymova, S. D. (I. M. Sechenov 1st Moscow Medical Inst., USSR). *Sov. Med.* (2):21-26, 1975.

7689 STRUCTURAL AND FUNCTIONAL INVESTIGATIONS OF THE LIVER AND VALUE OF THE ELECTRON MICROSCOPIC METHOD IN CHRONIC HEPATITIS IN CHILDREN. *(Rus.)* Ebels, I. G.; Sinelnikova, M. P. (Riga Medical Inst., USSR). *Pediatriia* (3):45-51, 1975.

7690 CYCLIC FLUCTUATIONS OF ENZYMATIC STATUS OF THE BLOOD LYMPHOCYTES DURING PREDNISOLONE TREATMENT IN CHILDREN WITH CHRONIC LIVER DISEASE. *(Rus.)* Chistova, L. V.; Shischenko, V. M.; Suslova, G. F.; Nartsissov, R. P. (Inst. Pediatrics, Moscow, USSR). *Pediatriia* (3):62-67, 1975.

7691 SURGICAL TREATMENT OF CHRONIC HEPATITIS. *(Fr.)* Milonov, O. B. (Inst. Clinical Experimental Surgery, Moscow, USSR). *Lyon Chir.* 71(2):85-88, 1975.

7692 RELATIONSHIPS BETWEEN BIOLOGICAL PROTIDOPOYESIS AND TRANSMETHYLATION: ACTIVITY OF S-ADENOSYLMETHIONINE ON PROTEIC CRASIS IN CHRONIC HEPATOPATHIES. *(It.)* Cantoni, L.; Maggi, G.; Mononi, G.; Preti, G. (Greater Hosp., Milan, Italy). *Minerva Med.* 66(33): 1581-1589, 1975.

7693 CHRONIC HEPATITIS: DIAGNOSTIC AND THERAPEUTIC PROBLEMS. *(It.)* Verme, G.; Rizzetto, M.; Bonino, F. (Ospedale Mauriziano, 46 Torino, Italy). *Minerva Med.* 66(31):1439-1452, 1975.

7694 INTRADERMIC REACTIVITY EVALUATION TO PPD-TEST IN CHRONIC LIVER DISEASES AND CIRRHOSIS. *(It.)* Sciaccaluga, M. (Clinica Medica Generale e Terapie Medica, Univ. delgi Studi, Modena, Italy). *Minerva Med.* 66(27):1295-1299, 1975.

7695 IMMUNOGLOBULINS, AUTOANTIBODIES, AND AUSTRALIA ANTIGEN IN CHRONIC HEPATITIS. *(Sp.)* Torruella, M.; Guardia, J.; Martinez-Vazquez, J. M.; Bacardi, R.; Tornos, J.; Mari, L.; Gallart, M. T.; Martin, M. D. C. (Departmentc de Medicina Interna de la Seguridad Social, Universidad Autonoma, Barcelona, Spain). *Rev. Clin. Esp.* 134(6):553-558, 1974.

7696 THIAZOLIDIN-CARBOXYLIC ACID IN THE AMBULATORY TREATMENT OF CHRONIC HEPATOPATHIES. *(Fr.)* Russu, G.; Lungu, I.; Boingeanu, A. (Inst. de Medecine, Pharmacie de Iasi, Iasi, Rumania). *Rev. Med. Chir.* 78(3):585-590, 1974.

7697 PATHOGENETIC ASPECTS OF IMMUNOGLOBULINS OF HAA POSITIVE AND HAA NEGATIVE LIVER DISEASES. *(Ger.)* Reis, H. E.; Bertrams, J.; Kuwert, E.; Selmair, H.; Wiese, W. (Medizinische Klinik I des Stadtkrankenhauses Kassel, Germany). *Med. Klin.* 69(39):1579-1586, 1974.

7698 THE EFFECT OF LOADING OF LYSOSOMES OF THE LIVER WITH TRITON WR 1339 ON THE DEVELOPMENT OF CHRONIC TOXIC HEPATITIS. *(Rus.)* Korolenko, T. A.; Titova, V. G.; Dobrovolskaya, S. G.; Yakobson, G. S. (Novosibirsk Medical Inst., Novosibirsk, USSR). *Biull. Eksp. Biol. Med.* 79(1):21-23, 1975.

7699 CHRONIC VIRAL HEPATITIS. *(E.)* Hadziyannis, S. J. (no affiliation given). *Clin. Gastroenterol.* 3(2):391-408, 1974.

See also, 6892, 7621, 7650, 7656, 7659, 7739, 7740, 7743, 7744.

## LIVER AND BILIARY TRACT

### Alcoholic Liver Disease

7700 ACUTE ALCOHOLIC HEPATITIS. PROGNOSTIC AND THERAPEUTIC PROBLEMS. *(Fr.)* Hecht, Y.; Benisty, H.; Caroli, J. (Service du Pr Caroli-Hopital St. Antoine 184, rue du Faubourg St. Antoine, 75012 Paris). *Med. Chir. Dig.* 3(6):383-388, 1974.

A retrospective study of 41 cases of acute alcoholic hepatitis (AAH) was directed toward the treatment of this affliction and the use of corticosteroid therapy. Two subgroups were designated: 21 uncomplicated cases and 20 severe forms. Severity was defined in terms of jaundice (bilirubin, 50 mg/l), major hemostasis changes (Quick < 40%, and/or accelerine < 50%), clinical encephalopathy with minimum liver flap and severe hypofixation of colloidal gold. The efficacy of the treatment was judged both on a short term (ST) basis (remission of the hepatocellular insufficiency) and a long term (LT) basis (length of survival and biological outcome) for the ordinary hepatitis and the surviving severe cases. In ST evolution, 12 patients were treated with corticosteroids; seven survived. Of the other eight who did not receive corticosteroids only two lived. On a LT basis in five patients (having undergone iterative laparoscopy) and in two verifications by autopsy, the development of an enlarged smooth liver towards a cirrhotic, nodular liver was observed. Despite the lack of randomization and the statistically nonsignificant difference in favor of corticosteroids, the authors conclude that corticosteroids may be used effectively in severe forms of AAH.

7701 SERUM FREE PROLINE AND FREE HYDROXYPROLINE IN PATIENTS WITH CHRONIC LIVER DISEASE. *(E.)* Mata, J. M.; Kershenobich, D.; Villareal, E.; Rojkind, M. (Instituto Nacional Nutrician, Mexico City, Mexico). *Gastroenterology* 68(5):1265-1269, 1975.

Levels of free proline and hydroxyproline were studied in patients with various diseases to determine whether these levels reflect the metabolic state of fibrous tissue in the liver of patients with alcoholic cirrhosis. The 133 subjects studied included 24 healthy controls, 45 alcoholics with cirrhosis, 15 nonalcoholics with cirrhosis, 11 patients with chronic active liver disease, nine patients with alcoholic hepatitis, 19 severely ill patients without liver disease and 19 malnourished patients. The amount of proline in normal sera was 0.158 μM/ml, and of hydroxyproline, 0.0067 μM/ml. Similar values were obtained in nonalcoholic patients with cirrhosis and patients with chronic active hepatitis. Both values were below normal in malnourished patients, although the difference was not statistically significant. Significantly lower serum proline values were seen in severely ill patients without liver disease (0.104 μM/ml). Serum proline and hydroxyproline were significantly increased in patients with alcoholic cirrhosis (0.232 and 0.0107 μM/ml, resp.). The highest values were found in the nine patients with alcoholic hepatitis, at 0.363 μM/ml for proline and 0.0112 μM/ml for hydroxyproline. These results show a significant increase in free proline and hydroxyproline in patients with alcoholic liver disease. It is suggested that the changes in free amino acids reflect an increase in collagen catabolism secondary to an increase in the rate of synthesis.

7702 PORTACAVAL SHUNT AS EMERGENCY PROCEDURE IN UNSELECTED PATIENTS WITH ALCOHOLIC CIRRHOSIS. *(E.)* Orloff, M. J.; Charters, III, A. C.; Chandler, J. G.; Condon, J. K.; Grambort, D. E.; Modafferi, T. R.; Levin, S. E.; Brown, N. B.; Sviokla, S. C.; Knox, D. G. (Sch. Medicine, Univ. California, San Diego). *Surg. Gynecol. Obstet.* 141(1):59-68, 1975.

A 12-yr evaluation is presented of emergency portacaval shunt in 138 consecutive patients with alcoholic cirrhosis and bleeding esophageal varices. In all patients, diagnostic examinations were completed within seven hr, and patients were operated on within 8.5 hr. Lifelong follow-up studies were made, and the factors influencing the patient survival were determined. Of patient characteristics (age, sex, history of alcohol intake, associated diseases, and the number of bleeding episodes) studied, only abstinence from alcohol for more than one month prior to bleeding (15% of patients; 71% survival) was associated with increased survival after surgery ($P < 0.05$). Clinical and laboratory findings of ascites on admission were associated with a 36% survival ($P < 0.001$). Systemic administration of posterior pituitary extract (20 U, i.v.) temporarily controlled varix bleeding in 94% of patients. All patients had portal hypertension, with a corrected average free portal pressure of 267 mm of saline. In 32% free portal pressure was not higher than hepatic occluded portal pressure prior to shunt, suggesting spontaneous reversal of portal blood flow. The early survival rate for this group of patients (38%) was significantly lower ($P < 0.05$) than that for the other patients (61%). There was no difference between the survival rate of 51% in patients receiving side-to-side portacaval shunt (106 patients) and the 59% survival rate for those undergoing end-to-side portacaval shunt (29). The statistically significant factors influencing survival were: abstinence from alcohol longer than one month preoperatively, absence of ascites, only mild to moderate muscle wasting, enlarged liver, no spontaneous reversal of portal flow, and complete postoperative abstinence from alcohol. The predicted age-adjusted seven-yr survival rate for these patients was 37%. The actual seven-yr survival rate of 40 patients operated on seven or more yr ago was 42.5%. It is concluded that emergency portacaval shunt is superior to nonoperative treatment and produces a significant increase in long-term survival. These data further suggest that a return to alcoholism is the most important factor influencing long-term survival, and its prevention lies in persistent and frequent observation.

7703 CHRONIC ETHANOL INTAKE BLOCKS THE INTESTINAL TRANSPORT OF SODIUM IN MAN. *(E.)* Mekhjian, H. S.; Sury, T.; Baba, N. (Ohio St. Univ., Columbus, Ohio). *Gastroenterology* 68(4):953, 1975.

7704 ALCOHOLIC HYPERTRIGLYCERIDEMIA: PREVALENCE AND CLINICAL CORRELATIONS. *(E.)* Lifton, L.; Scheig, R. (Dep. Gastroenterol., Univ. Connecticut, Hartford, Conn.). *Gastroenterology* 68(4):936, 1975.

7705 SYMPTOMATIC INTESTINAL DISACCHARIDASE DEFICIENCY IN ALCOHOLICS. *(E.)* Perlow, W.; Baraona, E.; Lieber, C. S. (Bronx VA Hosp., New York, N.Y.). *Gastroenterology* 68(4):935, 1975.

7706 PLASMA ESTRONE AND PROLACTIN CONCENTRATIONS ARE ELEVATED IN MEN WITH GYNECOMASTIC AND SPIDER ANGIOMATA. *(E.)* Van Thiel, D. H.; Gavaler, J. S.; Lester, R. (Dep. Med., Univ. Pittsburgh, Pittsburgh, Pa.). *Gastroenterology* 68(4):934, 1975.

7707 ETHYL ALCOHOL AND LIVER TRYPTOPHAN OXYGENASE. *(E.)* Kumar, G. K.; Hossain, Z.; Sardesai, V. M. (Wayne St. Univ. Sch. Med., Detroit, Mich.). *Gastroenterology* 68(4):931, 1975.

7708 CIRRHOSIS WITH SEVERE HYPOXIA AND ARTERIOVENOUS SHUNTS IN THE LUNGS: ONE CASE. *(Fr.)* Levy, V. G.; Beaugrand, M.; Vincent, J.; Zaoui, D. (Hopital St. Antoine, 75012 Paris, France). *Med. Chir. Dig.* 3(6):377-381, 1974.

7709 ALCOHOLIC HEPATITIS. *(Dut.)* Dees, J.; Gratama, S.; DeJong, M. (St. Franciscus Gasthuis, Rotterdam, Netherlands). *Ned. Tijdschr. Geneeskd.* 119(5):184-191, 1975.

7710 ALCOHOLIC HEPATITIS. STUDY OF 19 CASES. *(Por.)* Goncalves, C. S.; Boni, E. S.; Buaiz, V.; Zanotti, W. M.; Zanzandrea, B.; Pereira, F. E. L. (Centro Bio-Medico da UFES, 29000 Vitoria, ES, Brazil). *Arq. Gastroenterol.* 12(1):27-36, 1975.

7711 THE DIAGNOSIS OF CHRONIC ALCOHOLIC LIVER DAMAGE. *(Ger.)* Stotzner, H. (Medizinische Akademie "Carl Gustav Carus", Dresden, Germany). *Dtsch. Gesundheitsw.* 29(45):2143-2147, 1974.

7712 CLINICAL SYMPTOMS AND PROGNOSIS IN ACUTE ALCOHOLIC HEPATITIS. *(Ger.)* Kommerell, B. (Medical Clinic, Univ. Heidelberg, Heidelberg, Germany). *Therapiewoche* 24(51):6032-6033, 1974.

7713 ZIEVE'S SYNDROME. *(Ger.)* Uhl, N. (Medical Polyclinic, Univ. Heidelberg, Heidelberg, Germany). *Therapiewoche* 24(51):6033-6039, 1974.

7714 CLINICAL AND LABORATORY DIFFERENTIATION OF ALCOHOLIC HEPATITIS, FATTY LIVER, AND CIRRHOSIS. *(E.)* Cline, W.; Reinold, J.; Dernbach, W.; Heubner, T.; Fardal, P.; Olsen, W. A. (VA Hosp., 2500 Overlook Terrace, Madison, Wisc. 53705). *Wis. Med. J.* 74(7):78-80, 1975.

7715 RED CELL VOLUME IN ALCOHOLIC CIRRHOSIS. *(Fr.)* Jaulin, P.; Senecal, P.; Debray, C. (Hosp. Bichat, Paris, France). *Arch. Fr. Mal. App. Dig.* 63(8):631-637, 1974.

7716 ALCOHOLIC LESIONS OF THE LIVER (MORPHOLOGY AND SOME PROBLEMS OF PATHOGENESIS). *(Rus.)* Lebedev, S. P.; Potekaeva, M. A.; Mukhin, A. S. (Moscow, Med. Inst., USSR). *Arkh. Patol.* 37(32):54-62, 1975.

7717 THE LIVER FUNCTION IN PATIENTS WITH CHRONIC ALCOHOLIC DISEASE. *(Rus.)* Kosilova, L. M. (Kharkov Med. Inst., USSR). *Vrach. Delo* (4):32-34,1975.

7718 STUDIES OF THE LIVER FUNCTION IN PATIENTS WITH CHRONIC ALCOHOLIC DISEASE BY LABELLED ISOTOPE HEPATOGRAPHY. *(Rus.)* Shmakov, Iu. G.; Tarasov, B. M.; Vetlugin, A. A. (Chernigov Reg. Hosp., USSR). *Vrach. Delo* (4):30-32, 1975.

7719 CLINICAL PROBLEMS OF ALCOHOLIC CIRRHOSIS. I. BIOLOGICAL AND CLINICAL CHARACTERISTICS OF THE ALCOHOLIC CIRRHOSIS OF THE LIVER. *(Ser.)* Knezevic, S.; Falisevac, V.; Kallai, L.; Hadzic, N.; Pichler, E.; Spicer, F. (Dept. Med., Univ. Hosp. Zagreb, Yugoslavia). *Acta Med. Iugosl.* 28(4):399-353, 1974.

See also, 7183, 7212, 7612, 7854.

## LIVER AND BILIARY TRACT

### Cirrhosis

7720 SERUM HAPTOGLOBIN TYPE AND LIVER CIRRHOSIS. *(E.)* Hirayama, C.; Nakamura, M.; Koga, S. (Faculty Medicine, Kyushu Univ., Fukuoka, Japan). *Humangenetik* 28(2):139-146, 1975.

The distribution of haptoglobin phenotypes was studied in 105 patients (81 males and 24 females, age range 15-74 yrs) with liver cirrhosis of different etiology, and in 200 blood donors with positive and negative hepatitis B antigen (HBAg). Seventy-nine percent of the cirrhotic patients had a non-alcoholic etiology. HBAg and hepatitis B antibody (HBAb) were determined by immunoelectroosmophoresis and haptoglobins were phenotyped by vertical acrylamide gel electrophoresis. No significant differences in the haptoglobin gene ($Hp^1$) concentration were observed among the HBAg positive and negative donors; cirrhotic patients showed increased $Hp^1$ frequency, which was associated with non-alcoholic patients. Severe liver dysfunction was also associated with the presence of $Hp^1$. Since the family pedigrees of the patients with type 1-1, a haptoglobin phenotype, excluded individuals with type 2-2, the haptoglobin phenotype was stable in the cirrhotic process. $Hp^1$ was associated with severe liver dysfunction and $Hp^2$ was not. Therefore, $Hp^2$ may offer resistance to liver dysfunction.

7721 CONVERSION OF ANDROGENS TO ESTROGENS IN CIRRHOSIS OF THE LIVER. *(E.)* Gordon, G. G.; Olivo, J.; Rafii, F.; Southren, A. L. (New York Medical Coll., N.Y. 10229). *J. Clin. Endocrinol. Metab.* 40(6):1018-1026, 1975.

Androstenedione metabolism in cirrhosis of the liver and the role of this steroid and of testosterone as possible precursors for the estrogen excess in this disease were studied. The metabolic clearance rate of 7-α-$^3$H-testosterone and 7-α-$^3$H-androstenedione, their interconversions and conversions to estrone and 17β-estradiol were measured in 13 male patients with hepatic cirrhosis, and compared with results from 16 normal controls (eight men and eight women). The conversion ratio of androstenedione to estrone was significantly higher in patients than in normal

women. The conversion ratio of androstenedione to estradiol was significantly increased in patients over that in normal men and women. The conversion ratio of androstenedione to testosterone was also significantly higher in cirrhotics than in normal men and women. The conversion ratio of testosterone to estrone and to androstenedione was higher in cirrhotics compared with controls. The plasma concentration, the metabolic clearance rate, and the production rate of testosterone were significantly decreased in cirrhotics compared with normal men. Both the plasma concentration and the production rates of androstenedione were higher in cirrhotics than in normal men. There was greater instantaneous contribution of plasma androstenedione to estrone and estradiol in cirrhotics than in normal men. The instantaneous contribution of testosterone to estrone was increased about threefold in cirrhosis. These data indicate a significant alteration in androstenedione metabolism in men with hepatic cirrhosis.

7722 "HEPATIC" AND "EXTRAHEPATIC" TRIGLYCERIDE LIPASE ACTIVITY IN POST-HEPARIN PLASMA OF NORMALS AND PATIENTS WITH CIRRHOSIS OF THE LIVER. *(E.)* Bolzano, K.; Krempler, F.; Sandhofer, F. (First Dept. Medicine, Landeskrankenanstalten, A-5020 Salzburg, Austria). *Horm. Metab. Res.* 7(3): 238-241, 1975.

Liver triglyceride lipase (TGL) activity of postheparin plasma was measured in five male patients (aged 33-70 yr) with cirrhosis of the liver and in 12 healthy male subjects (aged 19-69 yr). The TGL activity was measured both with and without preincubation of postheparin plasma in protamine sulfate. Before and after incubation, the concentration of free fatty acids (FFA) was estimated. At 0.013 μM of FFA/ml/min, the protamine-resistant TGL activity was greatly reduced in patients with cirrhosis when compared with the control level of 0.266 μM of FFA/ml/min. The protamine inactivated TGL activity was normal. Analysis of serum of the cirrhosis patients revealed no inhibitor of the postheparin TGL. The activity of the protamine-resistant TGL of postheparin plasma was reduced to nearly zero in some patients with markedly impaired liver function. These findings, in agreement with animal experiments conducted earlier, indicate that the protamine-resistant TGL of postheparin plasma is of hepatic origin, while the protamine-inactivated TGL is released from extrahepatic tissues. "Hepatic" TGL activity was about twice as high as the "extrahepatic" TGL activity when measured with an artificial substrate in the postheparin plasma of normal individuals. Based on the results of this study, preincubation with protamine sulfate in a final concentration of 12 mg/ml for 10 min at 27 C is an appropriate method for the selective measurement of hepatic and extrahepatic TGL in human postheparin plasma.

7723 ARTICULAR MANIFESTATIONS OF PRIMARY BILIARY CIRRHOSIS. *(Fr.)* Majer, L.; Dorfmann, H.; Vitale, C.; Kahn, M. F.; de Seze, S. (Lariboisiere Hosp., Paris, France). *Ann. Med. Interne (Paris)* 125(12):933-938, 1974.

Articular manifestations of primary biliary cirrhosis in four patients are reported. Demineralizing osteopathy, followed by xanthomatosis and hyperglobulinemic and cryoglobulinemic purpura were found in one 29-yr-old female patient in whom primary biliary cirrhosis was preceded by acute articular manifestations for 2 yr. Portal hypertension, chronic polyarthropathy, Raynaud's syndrome, Sjogren's syndrome, sclerodactylia, mixed cryoglobulinemia, and diffuse sarcoidosis were established in another 48-yr-old female. Neural dystrophy, scleroderma, cryoglobulinemia, and latent hepatopathy (clinically compatible with chronic biliary cirrhosis) were found in a 63-yr-old male patient. The typical case of a 57 yr-old male patient showed persistent Raynaud's syndrome, telangiectasia of the face, bilateral tibiotarsal arthritis, increased sedimentation reaction, increased IgM level, the presence of mitochondrial antibodies, and slightly increased transaminase level. Australia antigen was not found. Liver biopsy resulted in the diagnosis of chronic biliary cirrhosis.

7724 PRIMARY BILIARY CIRRHOSIS AND MEDICAL TREATMENT OF CHOLESTASIS. *(Nor.)* Stave, R. (Rikshospitalet, Medisinsk audeling A, Norway). *Tidsskr. Nor. Laegeforen* 95(5):296-298, 1975.

Studies on the etiology, pathogenesis, clinical aspects, and prognosis of primary biliary cirrhosis are reviewed, and the medical treatment of the resulting cholestasis is described. Laboratory tests in primary biliary cirrhosis usually reveal increased plasma IgM level, increased alkaline phosphatase level, and positive lipoprotein-X test. Primary biliary cirrhosis can be distinguished from primary and secondary sclerosing cholangitis, and chronic drug-induced cholangitis. While there is no specific therapy for primary biliary cirrhosis available, early diagnosis is essential in view of the treatment of cholestasis, which consists of low-fat diet, diet with medium chain triglycerides, and the administration of liposoluble vitamins such as vitamin A, K and D, as well as calcium. Itching, assumed to be a result of the accumulation of bile salts in the serum, can be controlled by cholestyramine and orally administered anion exchangers.

7725 FIBRINOGEN SURVIVAL IN CIRRHOSIS: IMPROVEMENT BY 'LOW DOSE' HEPARIN. *(E.)* Coleman, M.; Finlayson, N.; Bettigole, R. E.; Sadula, D.; Cohn, M.; Pasmantier, M. (Cornell Univ. Medical Center, 525 E. 68th St., New York, N.Y. 10021). *Ann. Intern. Med.* 83(1):79-81, 1975.

The survival of radiolabeled [$^{125}$I] fibrinogen was studied in six cirrhotic patients. All patients were in end-stage cirrhosis, and received low-dose heparin therapy (3000 U sodium heparin in 5% glucose every 6 hr in a constant i.v. infusion). [$^{125}$I] Fibrinogen (autologous in three patients and homologous in three; 20 μCi) was injected i.v., and plasma samples were obtained at 30 min, one, three, and six hr, and then every 12 hr following injection. The mean fibrogen survival before heparin therapy was 52 hr and

during therapy, 101.8 hr. The median survival was 56 hr before therapy, and 91 hr during therapy. Evidence of defibrination in these patients included low levels of fibrinogen, platelets, plasminogen, and blood factors II, V, and VII were found. Further evidence for defibrination was the shortened survival of labeled fibrinogen. These data suggest that the defibrination process is a result of disseminated intravascular coagulation. The improvement of fibrinogen survival on low-dose heparin suggests that such doses, although not significantly altering the whole blood clotting time, probably play an active role in the coagulation process.

7726 USE OF BLOOD COMPONENT THERAPY FOR GASTROINTESTINAL BLEEDING IN PATIENTS WITH CIRRHOSIS OF THE LIVER. *(E.)* Sampliner, R. E.; Mobarhan, S.; King, D. M.; Greenberg, M. S.; Iber, F. L.; Grace, N. D. (Lemuel Shattuck Hosp., 170 Morton St., Boston, Mass. 02130). *Johns Hopkins Med. J.* 136(4): 163-167, 1975.

Replacement schedules with different proportions of fresh blood and component therapy consisting of fresh-frozen plasma, platelet concentrate, and packed RBC were compared in bleeding cirrhotic patients. The diagnosis of Laennec's cirrhosis was histologically confirmed in 40 of 50 hospitalized patients, all with gastrointestinal bleeding requiring blood transfusion. The blood replacement schedules included: 1) all fresh blood; 2) 1 U fresh blood following 2 U bank blood; and 3) 1 U packed cells, 1 U fresh-frozen plasma, and 2 U platelet concentrate (component therapy) following each 2 U of bank blood. Each patient had serial determinations of hematocrit, prothrombin time, fibrinogen, platelet count and liver function tests. Esophageal varices were the only source of bleeding in 50% of patients, and hemorrhagic gastritis was the only source in 20%. There were no significant differences in age, sex, liver function tests, hematocrit, fibrinogen level, platelet count, and prothrombin time at the time of assignment into the treatment groups. The blood replacement groups did not differ in mortality: five of 17 in group 1 died; four of 16 in group 2; and six of 17 in group 3. The overall mortality was 30%. The mean units of blood replaced and the mean duration of bleeding for the groups were not significant. Analysis by linear regression showed no significant correlation between the mean age of the plasma in 45 patients in whom it could be determined and the units of blood replacement or the duration of bleeding. No correlation was found between the age of RBC and the units of cells replaced or the duration of bleeding. The frequency of hepatic coma and functional renal failure and the need for further intervention to stop bleeding were similar for the three groups. The mortality in patients with severe coagulation defects (seven of 10) was significantly greater than in those without severe coagulation defects (eight of 40). It is concluded that the failure to correct these coagulation abnormalities might provide an explanation for the inability of any of the blood replacement schedules to demonstrate a clinical advantage.

7727 ACUTE POSTOPERATIVE PERICARDITIS IN TWO CASES OF PRIMARY BILIARY CIRRHOSIS. *(Fr.)* Delmont, J.; Lafon, J.; Cassuto, P.; Rampal, P. (Cent. Hepato-Gastro-Enterol., Nice, France). *Ann. Gastroenterol. Hepatol.* 11(2):99-108, 1975.

Acute post-operative pericarditis was observed in two patients with primary biliary cirrhosis on the third and ninth days following a surgical procedure (bone biopsy, portacaval anastomosis). The patients exhibited pain in the pericardial region, elevation of temperature and typical alteration in electrocardiograph readings. The possibility of auto-immune etiology of these cases of pericarditis was indicated by: negative rheumatism, collagen, viral and allergic tests, the presence of anti-heart antibodies, the spectacular effect of corticotherapy and the striking similarity between these two cases and immunologic pericarditis of post-pericardiotomy syndrome and Dressler syndrome. It is suggested that strict cardiological monitoring of these patients, particularly after surgery, might lead to an understanding of this cause-effect relationship.

7728 CONTROLLED TRIAL OF AN ANABOLIC AGENT IN CIRRHOTICS. *(Fr.)* Nusinovici, V.; Lageron, A.; Gateau, P.; Hecht, Y.; Caroli, J. (Hopital Saint-Antoine, 184, rue du Faubourg Saint-Antoine, 75571 Paris Cedex 12, France). *Sem. Hop. Ther.* 50(9):593-594, 1974.

The effect of stanozolol, an alkylized synthetic anabolizing steroid in C 17 α, was studied on cirrhotics. Clinical and biological studies were run on 15 treated cirrhotics (group 1a) and 13 nontreated cirrhotics (group 2a). The average length of the study was 90 days for group 1a and 120 days for group 2a. The prescribed doses of stanozolol were a function of change in the patients' conditions. The total dose was between 1 and 2.5 g. No other therapy was used. Tests performed were determinations of: BSP, total bilirubin, SGPT, serum phospatases, accelerin, albuminemia, plasmotic mass, mass of circulating albumin and gammaglobulins. Autoradiographic studies were performed on five cirrhotics treated by 50 mg of stanozolol/day for 1 mo (group 1b) and on six cirrhotics receiving neither anabolizers, corticoids, or vitamin-therapy (group 2b). Three hepatic biopsies were performed to study tritiated uridine and tritiated thymidine incorporation. The clinical and biological evolution was better in group 1a than in 2a. Two parameters were significantly improved: the mass of circulating albumin and accelerin. The autoradiographical studies showed consistent similarity between groups 1b and 2b in RNA study. Stanozolol appears to be a low-risk, satisfactory treatment for hepato-cellular insufficiency in cirrhosis.

7729 REVERSIBILITY OF EXTENSIVE LIVER DAMAGE IN GALACTOSEMIA. *(E.)* Applebaum, M. N.; Thaler, M. M. (Dept. Pediatrics, Univ. California, 3rd Ave. and Parnassus St., San Francisco, Calif. 94143). *Gastroenterology* 69(2):496-502, 1975.

A case report was presented illustrating the complete recovery of normal hepatic histology after extensive liver damage in a female infant with galactosemia. Examination of the infant prior to treatment revealed a 1 kg weight loss (birth weight, 4 kg) by 14 days of age, and by 28 days of age, a failure to thrive, hepatomegaly and jaundice were observed. Galactosemia was confirmed by the absence of galactose-1-phosphate uridyltransferase activity in the RBC. Percutaneous liver biopsy revealed distorted hepatic architecture: extensive periportal and intralobular fibrosis, ductular dysplasia, "pseudoglandular" transformation (liver cells arranged in acinar formation around a central space usually filled by a bile plug), distortion of periportal vasculature, and cells with prominent fatty deposits. A galactose-free diet was instituted. Symptoms disappeared within a few days and by 3 mo, clinical and biological evidence of liver disease disappeared. At 5 mo, a second biopsy revealed no evidence of fibrosis, fatty change or lobular disarray. These findings demonstrate that functional and histologic abnormalities associated with cirrhosis can be completely reversed by dietary management in galactosemia; however, early diagnosis and immediate exclusion of galactose from the diet are necessary.

7730 DISORDERS IN IRON METABOLISM IN ALCOHOLIC CIRRHOSIS. *(Fr.)* Terasse, J.; Moinade, S.; Jarrige, J. C. (Med. Clin. B., Clermont-Ferrand, France). *Rev. Fr. Gastroenterol.* (102):39-42, 46, 1974.

In a group of 82 alcoholics (68 men and 14 women), blood iron concentrations were increased in 23 of the men (33.8%) and in seven of the women (50%). The siderophyllin saturation coefficient (normal, 33%) was above 45% in seven of the women (50%) and in 31/66 men (45%), but siderophyllin concentrations were decreased (below 1800 mg) in 78% of these alcoholics. Disorders in iron metabolism appeared to be more pronounced in 59 patients with decompensated cirrhosis than in 15 with initial clinical and biological signs of cirrhosis or in eight with large alcohol intakes but no clinical or biological evidence of cirrhosis. The mean blood iron concentration and siderophyllin saturation coefficient were increased and the mean blood siderophyllin concentration was decreased in 11 patients with bronzed skin. Endocrine disorders and disorders in the regulation of sugar metabolism were diagnosed in five of these patients, but no liver biopsies were performed so that a diagnosis of hemochromatosis could not be confirmed. Endocrine disorders were diagnosed in 34 of the cases; in 20 of these they were associated with impotence or amenorrhea. Disorders in the regulation of sugar metabolism were found in 51.2% of these patients; 26% had manifest diabetes and 25% had latent diabetes. Very few liver biopsies were performed since many of these patients had very low prothrombin levels. No relation was found between abnormalities in iron metabolism and the endocrine disorders or latent or manifest diabetes.

7731 PRIMARY BILIARY CIRRHOSIS. *(Ger.)* Kuhn, H. A. (Aus der Medizinischen Universitatsklinik, Wurzburg, Germany). *Ergeb. Inn. Med. Kinderheilkd.* 35:1-41, 1974.

7732 HEMORRHAGIC CRUVEILHIER-BAUMGARTEN'S CIRRHOSIS TREATED BY OMPHALO-CAVAL ANASTOMOSIS. ELEVEN YEAR FOLLOW UP. *(Fr.)* Vaillant, J.; Goyer, B.; Juillard, J.; Ronceray, J.; Caron, J.; Lhoste, Ph. (Clinique Saint-Martin-la-Foret, 49-Angers, France). *J. Chir.* 108(5):441-448, 1974.

7733 EXTRAHEPATIC PORTAL HYPERTENSION WITH PULMONARY HYPERTENSION IN A 22-YEAR-OLD WOMAN. *(Cz.)* Brozman, M.; Jakubovsky, J. (Univ. Komenskeho, Bratislava, Czechoslovakia). *Bratisl. Lek. Listy* 63(2):159-166, 1975.

7734 THE EFFECTS OF β-ADRENERGIC BLOCKADE ON CIRRHOTIC ASCITES. *(E.)* Panitch, N. M.; Cole, D.; Samloff, I. M.; Horton, R. (Harbor Gen. Hosp., Torrance, Calif.). *Gastroenterology* 68(4): 965, 1975.

7735 ALPHA-1-ANTITRYPSIN DEFICIENCY LIVER DISEASE IN AN ADULT. *(E.)* Leach, B. E.; Slay, F. M.; Voorhies, N. W. (South. Baptist Hosp., New Orleans, La.). *Gastroenterology* 68(4):933, 1975.

7736 VALIDITY OF ANTIMITOCHONDRIAL ANTIBODY (AMA) TEST IN PRIMARY BILIARY CIRRHOSIS (PBC): STUDIES OF REAGENT VARIABLES. *(E.)* Winter, S. L.; Kraft, S. C.; Boyer, J. L. (Dep. Med., Univ. Chicago, Chicago, Ill.). *Gastroenterology* 68(4): 929, 1975.

7737 DOUBLE-BLIND POLYCENTRIC STUDY ON THE ACTIVITY OF SULPHO-ADENOSYL-L-METHIONINE IN HEPATIC CIRRHOSIS. *(It.)* Labo, G.; Miglio, F.; D'Ambro, A.; Bellobuono, A.; Ideo, G.; Dioguardi, N.; Avogaro, P.; Pasquino, M. (2nd. Dep. Med., Univ. Bologna, Venice, Italy). *Minerva Med.* 66(33):1590-1594, 1975.

7738 S-ADENOSYL-METHIONINE: PLASMA LEVELS IN HEPATIC CIRRHOSIS AND FIRST RESULTS WITH ITS CLINICAL USE IN HEPATOLOGY. DOUBLE-BLIND STUDY. *(It.)* Ideo, G. (3rd. Dept. Medicine, Univ. Milan, Milan, Italy). *Minerva Med.* 66(33):1571-1580, 1975.

7739 THERAPEUTIC ACTIVITY OF SULPHO-ADENOSYL-METHIONINE IN SOME CHRONIC HEPATOPATHIES. *(It.)* Labo, G.; Gasbarrini, G. B. (2nd Dept. Medicine, Univ. Bologna, Bologna, Italy). *Minerva Med.* 66(33):1563-1570, 1975.

7740 SERUM IMMUNOGLOBULINS IN CHRONIC LIVER DISEASE IN CHILDREN. *(Rus.)* Fokina, T. V.; Chistova, L. V. (Inst. Pediatrics, Moscow, USSR). *Pediatriia* (3):52-57, 1975.

7741 PLASTICITY OF THE LYMPHATIC BED OF THE HUMAN ESOPHAGEAL WALL IN CIRRHOSIS. *(Rus.)* Borisov, A. V.; Shipulin, A. N. (Leningrad Medical Inst. Sanitation Hygiene, USSR). *Arkh. Patol.* 37(3): 47-51, 1975.

7742 EVALUATION OF HEPATIC ENCEPHALOPATHY IN PORTACAVA SHUNTS AND MESENTERICO-CAVA BY-PASS WITH THE JUGULAR VEIN. *(It.)* Thau, A.; Bucci, L.; Ziparo, V.; Schillaci, A. (1st Sch. Semeiotic Surgery, Univ. Rome, Rome, Italy). *Minerva Chir.* 30(8):449-453, 1975.

7743 DOUBLE-BLIND TRIAL ON THE THERAPEUTIC ACTIVITY OF SAMe, ADMINISTERED PER OS, IN HEPATIC CIRRHOSIS AND CHRONIC HEPATITES [SIC]. *(It.)* Miglio, F.; Stefanini, G. F.; Corazza, G. R.; D'Ambro, A.; Gasbarrini, G. (Dep. Medical Pathol., Univ. Bologna, Bologna, Italy). *Minerva Med.* 66(33):1595-1599, 1975.

7744 HEPATITIS B ANTIGEN IN PATIENTS WITH CHRONIC LIVER DISEASES. *(Ser.)* Julijana, M.; Filipovic, D.; Stajic, M. (Mother Child Health Inst. Serbia, Belgrade, Yugoslavia). *Med. Pregl.* 27(9-10): 395-398, 1974.

7745 HEPATIC ENCEPHALOPATHY: CLINICAL ASPECTS AND TREATMENT. *(Rum.)* Mardare, G. (Institutul de Medicina si Farmacie, Jassy, Rumania). *Rev. Med.-Chir.* 78(3):559-564, 1974.

7746 AUSTRALIA ANTIGEN IN CIRRHOSIS. A STUDY OF 100 CASES IN GREECE. *(Fr.)* Yannitsiotis, A.; Schizas, N.; Lalos, J. (Hopital des Assurances Sociales 1.K.A. "Pendelli", Melissia-Athenes, Greece). *Ann. Gastroenterol. Hepatol.* 11(2):135-141, 1975.

7747 CHANGES ON RETROGRADE CHOLANGIOGRAMS IN PRIMARY BILIARY CIRRHOSIS OF THE LIVER. *(Ger.)* Safrany, L.; Ambrus, C.; Barna, L.; Buki, B.; Magyar, I.; Szalay, F. (I. Medizinischen klinik, Semmelweis-Universitat, Budapest, Hungary). *Fortschr. Rontgenstr.* 120(3):258-263, 1974.

7748 THE FREQUENCY OF CIRRHOSIS IN THE "HOSPITAL DE CLINICAS DE BUENOS AIRES" (1900-1969). *(Sp.)* Koch, O. R.; De Garcia, I. A. (Dept. Medicine, Univ. Buenos Aires, Buenos Aires, Argentina). *Acta Gastroenterol. Latinoam.* 6(2):63-68, 1974.

7749 MANAGEMENT OF THE PATIENT WITH LIVER CIRRHOSIS IN MEDICAL PRACTICE. *(Ger.)* Kinzlmeier, V. H. (St. Rochus-Krankenhaus, Bad Mergentheim, Germany). *Fortsch. Med.* 93(2):43-48, 1975.

7750 BLEEDING ESOPHAGEAL VARICES. *(Sw.)* Aschberg, S. (Dept. Surgery, Serafimer Hosp., Stockholm, Sweden). *Lakartidningen* 71(49):5063-5070, 1974.

7751 PORTAL OBSTRUCTION WITHOUT CHANGE IN HEPATIC PARENCHYMA. TWO CASES OF MESENTERICO-CAVAL BY-PASS. LATE RESULT—RECENT TECHNIQUE. *(Fr.)* Goux, J. P.; Lauron, G.; Bus, J. J.; Barraya, L. (No affiliation given). *Chirurgie* 101(1):35-41, 1975.

See also, 6892, 6997, 7046, 7584, 7586, 7588, 7621, 7659, 7684, 7690, 7692, 7694, 7697, 7701, 7714, 7879.

## LIVER AND BILIARY TRACT

### Gallbladder and Biliary Tract Diseases

7752 CANCER OF THE BILE DUCT: THE OCCULT MALIGNANCY. *(Eng.)* Wanebo, H. J.; Grimes, O. F. (Univ. California Medical Cent., San Francisco, Calif. 94122). *Am. J. Surg.* 130(2):262-268, 1975.

A group of 51 patients (30 men and 21 women, average age 61 yr) with bile duct cancer were studied. The mean duration of symptoms was 8 mo. Major symptoms included abdominal pain, jaundice, pruritus, anorexia and weight loss. Jaundice, hepatomegaly, abdominal mass, and ascites were prominent signs. The laboratory findings indicated obstructive jaundice. Percutaneous transhepatic cholangiograms indicated obstruction in the biliary system. Operative cholangiograms *via* some portion of the extrahepatic ductal system, though frequently made, did not often diagnose malignant disease. The reasons for this lack of recognition of bile duct cancer in one third

of 45 patients undergoing initial laparotomy for clinical biliary tract obstructive disease were varied. The location of the tumor included the common duct or distal common duct in 17 patients, the junction of the cystic duct with the common duct in three, the cystic duct in three and the common hepatic duct in 13. Carcinoma was found in the right intrahepatic duct in four, and in the left hepatic duct in two, in both ducts in one and at the duct junction in eight. Obvious metastases to regional lymph nodes occurred in eight patients and metastases or extension to the liver occurred in 12. The operative mortality was 24%. The overall survival from onset of symptoms in patients who successfully underwent some type of surgery was 19.4 mo. Major postoperative complications occurred in 11 patients including external biliary fistula (two cases), acute cholangitis (two), hepatorenal syndrome (one), liver failure with cirrhosis (one), hemorrhagic shock with portal hypertension (one), thrombophlebitis with pulmonary emboli requiring ligation of the inferior vena cava (one), hemorrhagic gastritis (one), toxic brain syndrome (one) and wound infection (one). It is suggested that in order to detect these tumors more frequently during exploration of the extrahepatic biliary system, especially during cholecystectomy, biopsy specimens of any indurated area should be taken. The discovery of white bile in the common duct is highly suggestive of a malignant disease.

7753 ACTH-SECRETING 'APUDOMA' OF GALLBLADDER.
*(E.)* Spence, R. W.; Burns-Cox, C. J. (Frenchay Hosp., Bristol, England). *Gut* 16(6):473-476, 1975.

The case of a 44-yr-old woman with an ACTH-secreting carcinoma of the gallbladder is reported. The patient presented with features of Cushing's syndrome (facial plethora and hirsutes, an obese abdomen with striae, bruising, and obvious quadricep wasting). The liver was enlarged and palpable; serum alkaline phosphatase was 245 IU/liter. The patient also had two episodes of electrolyte imbalance. A dexamethasone suppression test demonstrated high basal levels of urinary cortisol precursors and derivatives; and two days of dexamethasone administration at 2 mg/day followed by two days at 8 mg/day showed a marked increase in cortisol derivatives and precursors and in adrenal androgens. Plasma cortisol and plasma ACTH (161 µg/ml) levels were also elevated. A metyrapone test two weeks later showed even higher basal steroid levels, and six 750 mg doses of metyrapone over 24 hr did not produce any significant alterations. At laparatomy, a large secondary tumor was found in the liver and a tumor was present in the gallbladder wall occluding Hartmann's pouch. Cytochemical evaluation of the hepatic tumor after death gave strongly positive enzyme reactions characteristic of amino precursor uptake and decarboxylation cells. Immunofluorescent studies with various antisera gave a positive reaction only with ACTH antiserum. Postmortem examination confirmed that the tumor had arisen from the wall of the gallbladder or cystic duct. This is apparently the first reported case of an ectopic hormone-producing tumor of the gallbladder.

7754 THE SEPARATION AND CHARACTERIZATION OF LIVER PLASMA MEMBRANE FRAGMENTS CIRCULATING IN THE BLOOD OF PATIENTS WITH CHOLESTASIS.
*(E.)* De Broe, M. E.; Borgers, M.; Wieme, R. J. (Univ. Hosp., 9000 Gent, Belgium). *Clin. Chim. Acta* 59(3):369-372, 1975.

Further studies were made of the doublet of alkaline phosphatase (AP) isozymes occurring in the serum of patients with cholestasis. The doublet had been characterized earlier by the simultaneous presence of a conventional liver AP and of a high-molecular weight isozyme, with a rapid migration pattern in agar gel electrophoresis (R fraction). Due to the possibility that the liver AP was associated with fragments of liver cell membranes, experiments were conducted to isolate this complex from serum. Satisfactory isolation of the R fraction complex was obtained. This material was checked for the presence of typical plasma membrane-bound enzymes and the following activities were demonstrated: AP (using paranitrophenyl phosphate), 5'-nucleotidase (using adenosine 5'-monophosphate), γ-glutamyl transpeptidase (using *N*-γ-L-glutamyl-α-naphthylamide), and L-leucyl-β-naphthylamidase (using leucine-*p*-nitranilide). The following enzymes were absent: SGPT, SGOT, lactate dehydrogenase, and acid phosphatase. Testing indicated this macromolecular complex was not identical to and did not contain the lipoprotein X. The demonstration of several other membrane-bound enzymes in the isolated complex suggests either a marked heterogeneity of the material, or a basic structural feature indicating a close relation to liver cell plasma membranes. Biochemical and electron-microscopic demonstration of the vesicular nature of this R fraction suggests that fragments of liver plasma membrane appear and continue to circulate in the blood of patients in an early stage of cholestasis.

7755 KINETICS OF CHOLESTEROL AND BILE ACIDS IN PATIENTS WITH CHOLESTEROL CHOLELITHIASIS.
*(E.)* Hepner, G. W.; Quarfordt, S. H. (Milton S. Hershey Medical Center, Pennsylvania State Univ., Hershey, Pa. 17033). *Gastroenterology* 69(2):318-325, 1975.

Kinetic studies of cholesterol and bile acids were performed on six Caucasians with cholesterol cholelithiasis (CC) and six healthy matched controls to determine the *in vivo* conversion of cholesterol to bile acid. The rate of biliary neutral sterol loss was also obtained. A 10-wk analysis of biliary lipids after a single injection (10-20 µCi) of labeled cholesterol was conducted in conjunction with a conventional 1-wk study of primary bile acid kinetics. During this period, samples of duodenal bile were taken daily for the first four days after injection and then on days 7, 10, 13, 18, 21, and weekly thereafter for the duration of the experiment. Kinetic values of two of six CC subjects were very similar to the controls. The remaining four CC patients showed smaller primary bile acid pools, significantly lower fractional conversions of cholesterol to both primary bile acids ($\lambda 31$, $\lambda 41$) with concomitantly lower bile acid flux, and a more gradual bile acid spe-

cific activity decay after the maximum. No significant differences were observed in the fractional conversion rate of rapidly miscible cholesterol pool (RMP) to total primary bile acid (λ31, λ41), fractional rate of loss and flux of biliary neutral sterol, or the fractional turnover of the primary acid pools of cholate (λ03) and chenodeoxycholate (λ04). The heterogeneity of the six patients suggests multifactorial processes in the pathogenesis of CC. It is possible that the two patients with kinetics similar to the controls may have had pigment stones rather than CC (diagnosis was made by observation of radiolucent stones; pigment stones were not differentiated from CC). This study suggests that RMP cholesterol conversion to primary bile acids may be defective in Caucasian CC patients with small primary bile acid pools. This defect may be due to an absolute deficiency in the hepatic content of 7α-hydroxylase, the rate-limiting enzyme for bile acid synthesis.

7756 CHENODEOXYCHOLIC ACID THERAPY FOR GALLSTONES: EFFECTIVENESS, TOXICITY AND INFLUENCE ON BILE ACID METABOLISM. *(E.)* James, O.; Cullen, J.; Bouchier, I. A. D. (Royal Free Hosp., London, England). *Q. J. Med.* 44(174):349-367, 1975.

The results of chenodeoxycholic acid treatment in 13 patients with various biliary tract disorders are reported. The biliary lipid and bile acid composition were measured before and during treatment in all patients. Bile acid pool size was determined before and during treatment in eight patients with gallstones. The patient group studied included six cases with small radiolucent stones (0.5 cm) and a functioning gallbladder, two with large radiolucent stones and a functioning gallbladder, two with radiolucent stones and a nonfunctioning gallbladder, and three with biliary stricture and recurrent cholangitis. Patients received chenodeoxycholic acid (1 g/day) for eight to ten months (gallstone patients) or for two to eight months. Of the ten patients with gallstones, four showed marked dimunition or disappearance of the stones following therapy. Of the six patients with multiple small radiolucent stones, three showed marked diminution or disappearance of stones after one-yr of treatment. Of three cases with biliary stricture, one received treatment for only two months and results were not conclusive. During the first six months of therapy in the other two, the number of cholangitis attacks fell from 24 to six and from 20 to five, resp., over a six-month period. There was a significant elevation in serum bile acid levels in eight gallstone patients, from a mean of 28.8 μM/liter before to a mean of 8.6 μM/liter after treatment. A liver biopsy in eight gallstone patients showed minor changes, including fatty vacuolation and siderosis in three, portal tract sclerosis in two, and portal tract and duct infiltration in one. There was no significant change in biliary lipid composition. Changes in biliary bile acid composition and bile acid pool sizes were variable and could not be correlated with the clinical results. These and previous results suggest that the varying effects of chenodeoxycholic acid treatment may be explained by a balance between the effects of reducing cholesterol synthesis and the variable expansion of the bile acid pool size from exogenously administered chenodeoxycholic acid. A further clinical trial is recommended.

7757 CHENODEOXYCHOLIC ACID TREATMENT OF GALLSTONES. A FOLLOW-UP REPORT AND ANALYSIS OF FACTORS INFLUENCING RESPONSE TO THERAPY. *(E.)* Iser, J. H.; Dowling, R. H.; Mok, H. Y. I.; Bell, G. D. (Guy's Hosp., London, SE1 9RT, England). *N. Engl. J. Med.* 293(8):378-383, 1975.

Seventy patients (15 men and 55 women, aged 24-76 yr) with gallstones were treated with chenodeoxycholic acid over a period of 3½ yr. Factors influencing the outcome of such therapy were analyzed. In 11 patients with radiopaque gallstones and in seven with nonfunctioning gallbladders, this treatment was not successful. Of the patients with radiolucent gallstones treated for six months or more, 64% showed partial or complete gallstone dissolution. Of those whose bile became unsaturated with cholesterol, 100% had evidence of dissolution. In patients with some degree of gallstone dissolution, the mean post-treatment biliary cholesterol saturation index was significantly less and the dose of chenodeoxycholic acid (14.4 mg/kg/day) significantly more than in those patients whose gallstones did not undergo any change. The results of this study show that chenodeoxycholic acid treatment should be confined to patients with radiolucent gallstones and functioning gallbladders. The dose should be based on body weight with a suggested dose of 14 to 15 mg/kg/day. The response to treatment should be confirmed by bile lipid analysis one to three months after start of treatment. If the treatment has resulted in an unsaturated bile, small radiolucent gallstones should show partial or complete dissolution within 12 months. Medium or large gallstones should give evidence of dissolving within two yr. Careful monitoring of liver function and assessment of liver structure is advisable in view of the slight changes in serum transaminase levels which have been observed.

7758 MALIGNANT PAPILLOMATOSIS OF THE EXTRAHEPATIC BILIARY TRACT. *(Ger.)* Adolphs, H. D.; Schlachetzki, J.; Breining, H.; Karhoff, B. (Marien Hosp., Aachen, Germany). *Med. Klin.* 69(46):1899-1902, 1974.

A 52-yr-old woman who had been hospitalized 1 yr previously for upper abdominal pain developed occasional diarrhea with acholic stools, dark urine and jaundice. SGOT, SGPT, alkaline phosphatase, and leucine aminopeptidase activities were increased, as was the relative percentage of $\alpha_2$- and β-globulins. The biliary tract was not visualized on i.v. cholangiography. In spite of administration of *N*-butylscopolammonium bromide, total serum bilirubin values continued to increase to 11.4 mg/100 ml. When the common bile duct was opened at laparotomy, gelatinous, papillomatous masses emerged. Removal of these masses with a scoop and by aspiration provided good bile flow into the duodenum. Histological examination of the masses

showed nuclear atypia but no evidence of infiltrative growth in any of the tissue obtained at surgery. A liver biopsy showed severe cholestasis with chronic cholangitis and pericholangitis evolving into cholangiohepatitis. The patient recovered uneventfully after surgery but was readmitted with a recurrence 3 months later. After surgical removal of the papillomatous masses and aspiration and curretage of the entire biliary tract, a choledochoduodenostomy was performed so that these masses could drain into the duodenum without interfering with bile flow. Again, histological examination of the masses failed to show evidence of infiltration. The patient was hospitalized for a second recurrence 10 months later, at which time ascites were also present. Carcinoma cells were found in the ascitic fluid on paracentesis. After symptomatic drug therapy, the patient was discharged, but died 6 months later from bronchopneumonia. At autopsy, the bile ducts were filled with papillomatous masses which completely plugged the choledochoduodenostomy; still no evidence could be obtained of infiltration into the walls of the bile ducts. Examination of the liver revealed purulent intrahepatic cholangitis, biliary cirrhosis, and multiple abscesses. One of these abscesses had perforated the capsule of the liver and produced subphrenic empyemia and peritonitis. No signs of intestinal polyposis were found. In contrast to two previously described cases of biliary papillomatosis, the rapidly progressive course and severe degree of cachexia in this patient are regarded as evidence of malignancy.

7759 OBSTRUCTIVE JAUNDICE IN PATIENTS WITH PANCREATITIS WITHOUT ASSOCIATED BILIARY TRACT DISEASE. *(E.)* McCollum, W. B.; Jordan, P. H. (Baylor Coll. Medicine, Houston, Tex.). *Ann. Surg.* 182(2):116-120, 1975.

Seven cases of obstructive jaundice in patients with pancreatitis without associated biliary tract disease are presented; the differential diagnosis between benign and malignant diseases is discussed. Case 1 was a diabetic, alchoholic man who had painless jaundice of four weeks duration. A distal pancreatectomy with pancreaticojejunostomy and decompression of the biliary system was performed. The pancreas removed at operation revealed chronic pancreatitis and no cancer. The patient died in 3 mo with disseminated carcinoma of the pancreas. This patient illustrated the difficulty of distinguishing between cancer and pancreatitis in the presence of painless jaundice and emphasized the fact that these conditions may coexist. Case 2 was a 38 year-old alcoholic with painful jaundice of 1 mo duration. The diagnostic dilemma in this patient was whether his juandice was related to intrahepatic disease due to alcoholism or to extrahepatic obstruction due to common duct stone, pancreatic inflammation or cancer. A pancreaticojejunostomy was performed. The patient lived and was well for 6 yr, and then died from respiratory and hepatic insufficiency. This fact provided evidence that pancreatitis rather than cancer was the correct diagnosis. Case 3 was a 76 year-old diabetic with painless jaundice for 6 mo. He was diagnosed as having acute and chronic pancreatitis. A distal pancreatectomy with pancreaticojejunostomy and cholecystojejunostomy were performed. This patient was over-treated and could have been managed by simple decompression of the biliary tree alone. Case 4 was a 44-yr-old diabetic, alcoholic patient with pancreatitis and cholelithiasis. A cholecystectomy, sphincterotomy and longitudinal jejunostomy were performed. Due to the continued intake of alcohol, pancreatitis progressed and a choledochogastrostomy was performed 1 yr later. He was still doing well after 7 yr. Patients 5 and 6 had pancreatic pseudocysts. Decompression of the pseudocyst immediately relieved the obstructive jaundice in the first patient but not in the second. Case 7 developed postoperative acute pancreatitis following a vagotomy and partial gastrectomy. He died following his third operation, which was required to drain an abcess on the pancreas. In conclusion, the differential diagnosis between benign and malignant diseases is extremely difficult in patients with painless, obstructive jaundice due to pancreatitis.

7760 COAGULATING EFFECT ON CALCIUM CARBONATE OF SULFATED GLYCOPROTEINS ISOLATED FROM PATHOLOGICAL BILE. *(E.)* Nagashima, H.; Suzuki, N.; Yosizawa, Z. (Tohoku Univ. Sch. Med. Sendai, Japan). *Tohoku J. Exp. Med.* 113(2):159-168, 1974.

Normal human biles and pathological biles from 2 patients who had undergone surgery for intrahepatic gallstones were fractionated centrifugally in the presence of salts. The coagulating effects of the resulting fractions on calcium carbonate suspension in water were then determined. Three of 6 fractions obtained from pathological bile had a coagulating effect, whereas no noticeable coagulating effect was found with fractions from normal bile. The major fraction (Fr. 2) from pathological bile coagulated the calcium carbonate suspension at a low concentration (%) of $10^{-3}$. Further fractionation of Fr. 2 on DEAE-Sephadex A-25 yielded several subfractions, 3 of which caused remarkable coagulation at concentrations (%) between $5 \times 10^{-4}$ and $5 \times 10^{-3}$. Fr. 2 and its active subfractions were characterized as sulfated glycoproteins by chemical analysis. Normal bile contained no sulfated glycoprotein. The data support previous findings suggesting that sulfated glycoproteins in bile are responsible for gallstone formation.

7761 BY-PASS ANASTOMOSIS OF INTRAHEPATIC DUCT TO THE GALLBLADDER. *(E.)* Scanlon, E. F.; Oviedo, M. A. (Evanston Hosp., Evanston, Ill.). *J. Surg. Oncol.* 7(4):319-322, 1975.

A procedure is reported to relieve a malignant obstruction of the extrahepatic bile duct. A 61-year-old man was admitted with adenocarcinoma of the sigmoid colon. The postoperative course was uneventful, but one yr later the patient was readmitted with severe jaundice. A percutaneous hepatic cholangiogram showed complete obstruction of proximal hepatic duct. A biliary anastomosis was attempted using the gallbladder and patent cystic duct as bypass circuit. One

branch of a T-tube was inserted into the bile duct and the other branch into the gallbladder; the long limb of the T-tube was brought out to the skin. The T-tube worked postoperatively but the patient expired two months later. Postmortem revealed massive replacement by the liver by metastasis from the adenocarcinoma; the bypass remained intact. This procedure is indicated if the gallbladder-cystic duct is patent and if the patient is not a candidate for radical curative procedures.

7762 POLYMICROBIAL SEPSIS FOLLOWING ENDOSCOPIC RETROGRADE CHOLANGIOPANCREATOGRAPHY. *(Eng.)* Elson, C. O.; Hattori, K.; Blackstone, M. O. (Univ. Chicago Pritzker Sch. Medicine, Box 400, 950 E. 59th Street, Chicago, Ill. 60637). *Gastroenterology* 69(2):507-510, 1975.

Cholangitis with polymicrobial sepsis followed an endoscopic retrograde cholangiopancreatography (ERCP) performed in a 54-yr-old woman without extrahepatic obstruction. Eighteen hr after ERCP, the patient developed a 40 C fever, right upper quadrant pain and tenderness. Blood cultures grew *Pseudomonas aeruginosa* and *Enterobacter aerogenes*. ERCP equipment was examined and found to be the source of the infection. *Pseudomonas* and enterobacteriaceae flourished in the equipment after the standard disinfection procedure of soap, water, and 70% alcohol. Following a 2% gluteraldehyde disinfection procedure, only mouth flora were cultured. Prevention of ERCP-related sepsis through more effective instrument disinfection is suggested.

7763 THE NEGATIVE CHOLECYSTOGRAM IN GALLBLADDER DISEASE. *(Eng.)* Reid, D. R. K.; Rogers, I. M. (Royal Glasgow Infirmary, Glasgow, Scotland). *Br. J. Surg.* 62(7):581-583, 1975.

Seventeen patients (two men and 15 women, aged 21-70 yr) are presented who suffered from typical, severe, and recurrent biliary colic. In each of these patients, on at least one occasion, cholecystography findings were negative. The cholecystogram was repeated several times in six patients, and in three instances a normal i.v. cholangiogram was obtained. One patient had one normal cholecystogram and one normal i.v. cholangiogram. The cholecystogram was abnormal on one occasion in four patients. In two patients normal findings became abnormal over five and 11 yr, resp., while the symptoms remained the same. In the two other cases, abnormal cholecystogram initially became normal after three and nine months, resp. The duration of symptoms ranged from six months to 25 years, with an average of 7.5 yr. In each case there was an observation of at least several months before a final diagnosis was made. The major symptom in each case was pain, typical in nature and lasting from several hr to several days. Transitory jaundice occurred in five patients, and in one patient six times. Of these five, two had cholesterol stones in the gallbladder, one had biliary mud and two had no stones at operation. "Subclinical" jaundice developed in three patients, both with and without stones at operation. The frequency of jaundice and cholecystitis were nearly the same in the group of nine patients with stones and the group of eight patients without stones at operation. The symptoms in these patients were explained on the basis of "disappearing stone". Both groups were totally relieved of the attacks of pain by cholecystectomy and the postoperative follow-up was similar. It is suggested that cholecystectomy be considered in patients such as these provided the symptoms are sufficiently characteristic and severe.

7764 CLASSIFICATION OF CHOLEDOCHODUODENAL FISTULA DIAGNOSED BY DUODENAL FIBERSCOPY AND ITS ETIOLOGICAL SIGNIFICANCE. *(E.)* Ikeda, S.; Okada, Y. (First Dep. of Surgery, Kyushu University, Fukuoka, Japan). *Gastroenterology* 69(1):130-137, 1975.

Two types of choledochoduodenal fistulas were studied with duodenal fiberscopy and endoscopic cholangiography. Of 146 patients with cholelithiasis, choledochoduodenal fistulas were diagnosed in 20. Type I fistula was usually present on the longitudinal fold just orad to the papillas; it was small and arose from the intramural portion of the slightly enlarged common bile duct. Type II fistula was present at the duodenal mucosa adjacent to the longitudinal fold; it was large and arose from the extramural portion of the highly dilated common bile duct. Type I was found in 8 of 20 cases and type II in 12 of 20 cases. Type I fistulas are postulated to be caused by the impaction of a gallstone too large to pass the duodenal papilla. Type II fistulas are caused by a gallstone too large to enter the common bile duct and therefore impacted into the extramural portion. The recent introduction of the duodenal fiberscope and cholangiography have made the diagnosis of choledochoduodenal fistulas easier and more reliable.

7765 VALUE OF LAPAROSCOPY IN HEPATOBILIARY DISEASE *(E.)* Cuschieri, A. (Dept. Surgery, University Liverpool, England). *Ann. R. Coll. Surg. Engl.* 57(1):33-38, 1975.

A prospective study was undertaken to assess the value of laparoscopy in the investigation of hepatobiliary disease. A group of 33 consecutive patients aged 25-70 yr with cholestatic jaundice had a laparoscopy immediately prior to laparotomy in order to compare the diagnostic yield between laparoscopy with that of laparotomy and operative choledochography. Pathology was accurately diagnosed by laparoscopy alone in 21 of 33 cases. Laparotomy and operative choledochography made the diagnosis possible in every case. Another group of 25 patients with advanced cancer (gastrointestinal tract--14, breast cancer--nine, and bronchus--two) were investigated for hepatic involvement by secondary tumor using both laparoscopy and hepatic scintiscanning with $^{99m}$Tc-sulfocolloid. Laparsocopy gave a slightly better diagnostic yield (28%) for secondary tumor deposits than hepatic scintiscanning (28%); the combined use of both methods reduced the false negative rate to 11%. Laparoscopic liver biopsy was superior to blind percutaneous biopsy in the retrieval of secondary malignant

tissue, but it had no obvious advantage over the latter in patients with diffuse disease (cirrhosis) or primary hepatic tumors.

7766 PERITONEOSCOPY IN DIFFERENTIAL DIAGNOSIS OF JAUNDICE. *(Rus.)* Trofimov, V. M. (S. P. Fedorov Fac. Chir. Clin., S. M. Kirov Mil. Med. Acad., Leningrad, USSR). *Vestn. Khir.* 114(5): 45-49, 1975.

Peritoneoscopy tests (162) were performed on 158 patients (93 men and 65 women, aged 16-78) with bilirubinemia (1.5 mg% and higher). This included: 50 patients with swelling of the biliopancreatic region, bile ducts or liver; 37 patients with cirrhosis of the liver; 36 patients with various forms of hepatitis; 21 patients with gallstones; seven patients with other diseases (lymphogranulomatosis, functional hyperbilirubinemia, hemolytic jaundice and indurative pancreatitis). In seven patients, no distinct diagnosis could be established and these patients were dropped from further consideration in the study. In 74 cases, the jaundice was determined as mechanical; in 77 cases as parenchymatous. Peritoneoscopic studies revealed distinct differences in the color of the liver in both kinds of jaundice. Endoscopy gave a correct diagnosis of mechanical jaundice in 84% of the cases; it was correct in 96% of the cases of parenchymatous jaundice. It is also possible, by means of peritonescopy (judging by the appearance of the liver and gallbladder), to obtain an idea about the site and character of the thrombosis of the bile ducts.

7767 HEPATIC PORTOENTEROSTOMY (THE KASAI OPERATION) FOR BILIARY ATRESIA. *(E.)* Lilly, J. R.; Altman, R. P. (Univ. Colorado Medical Center, Denver). *Surgery* 78(1):76-86, 1975.

The results of hepatic enterostomy (Kasai operation) in the treatment of 22 infants with biliary atresia over a 2 1/2 yr period are presented. Their age at operation ranged from 3 weeks to 17 months; the majority had surgery at six to 12 weeks. The diagnosis of biliary atresia was established at surgical exploration and confirmed by liver biopsy. Use was made of a long (30 cm) Roux-en-Y intestinal segment, the middle of which was exteriorized as a Mikulicz double-barrelled cutaneous enterostomy. In patients with sustained and normal volume of bile drainage and in whom transhepatic cholangiography shows unimpeded flow through the anastomosis, the intestinal spur is subsequently crushed. Bile can be collected from one stoma and instilled into the other once or twice daily. The Mikulicz enterostomy is ultimately closed by an extraperitoneal operation. There were no operative deaths. Postoperative complications arose in two patients: injury of a branch of the portal vein during surgery and a subphrenic abscess. Evidence of bile drainage after operation was seen in 11 patients, determined by reduction in serum bilirubin levels of 50% or more, by improved or normal $^{131}$I-sodium Rose Bengal excretion studies, and in several cases by visualization of a functional biliary enteric anastomosis by transhepatic cholangiography. Bile drainage was not obtained in any patient older than 12 weeks nor in the absence of microscopic biliary ductules in the excised fibrotic remnant of the extrahepatic bile ducts. Ascending cholangitis occurred in all but three infants with postoperative bile drainage. Death occurred in three patients without bile drainage and in one with unrelenting cholangitis. Clinical evidence of residual and/or progressive liver disease was seen in 13 cases. Of the 22 infants, five are doing well from three months to more than two yr after surgery. It is suggested that, regardless of the complicating factor of recurrent cholangitis, hepatic enterostomy be considered for all infants with biliary atresia younger than 12 weeks at diagnosis.

7768 THE VALUE OF RADIOLOGY IN PREDICTING GALLSTONE TYPE WHEN SELECTING PATIENTS FOR MEDICAL TREATMENT. *(E.)* Bell, G. D.; Dowling, R. H.; Whitney, B.; Sutor, D. J. (Royal Postgraduate Medical Sch., London, England). *Gut* 16(6):359-364, 1975.

A prospective study is presented that correlates the preoperative radiological appearance of gallstones from patients undergoing elective cholecystectomy with the composition of the stones, as measured by x-ray diffraction and chemical analysis. The influence of age and sex on gallstone was also examined. Gallstones were obtained from 57 patients (42 women and 15 men, aged 25-89 yr). All stones were analyzed by x-ray diffraction. Clinical radiographs were obtained in 50 of these; 50 stones underwent chemical analysis, and clinical radiographs were available for 47 of these. X-ray diffraction showed that gallstones from women contained more cholesterol than those from men, while stones from women under 50 yr contained approximately 15% more cholesterol than those from older women. The relative proportions of the different substances present in gallstones from both sexes were: 60%, stones with more than 95% cholesterol; 23%, mixed stones with less than 70% cholesterol; and 14%, stones composed of calcium salt crystals. Of the 50 gallstones analyzed chemically, 68% contained more than 70% cholesterol. The mean cholesterol content in stones measured chemically was 72.7%, compared with the 68.3% weight given by x-ray diffraction. Of the 47 cases in whom both radiographs and chemical analyses were available, 24 stones were radiolucent (86.2% mean cholesterol) and 23 radio-opaque (59.0% mean cholesterol). The difference in cholesterol content was statistically significant. A 20% incidence of radiographic false-positives was found in patients with small, irregular, radiolucent stones which subsequently proved to be noncholesterol-rich. Large radiolucent stones with a smooth contour were usually cholesterol-rich. These results suggest that clinical radiography provides a reliable, but not completely accurate, indication of the gallstone type present.

7769 ENDOSCOPIC SPHINCTEROTOMY OF THE AMPULLA OF VATER AND REMOVAL OF COMMON DUCT STONES. *(E.)* Nakajima, M.; Kimoto, K.; Fukumoto, K.; Ikehara, H.; Kawai, K. (Kyoto Prefectural Univ. Medicine, Kyoto, Japan). *Am. J. Gastroenterology* 64(1):34-43, 1975.

The technique of endoscopic sphincterotomy for the removal of common duct stones *via* the ampulla of Vater is described. During a recent 16-mo period this procedure was used on 14 patients. After premedication with an antispasmodic agent and local anesthetic the duodenofiberscope was passed into the duodenum and the tip of the electrode was introduced into the ampulla through the biopsy channel. The free end of the electrode was connected to a diathermic unit and a blended current was used for cutting and coagulation to section the sphincter. Two types of basket-tipped catheters have been devised for extraction of stones. This procedure was accomplished in 11 of 14 patients without bleeding, perforation or complications. Short term follow-up indicated no remarkable changes in liver and pancreatic functions. Secondary inflammation of the bile duct and secondary pancreatitis have not been encountered. The clinical history and treatment of one case was described in detail. It is stressed that this method cannot replace surgical sphincterotomy because the anatomic sphincteric mechanism is not completely sectioned.

7770 RECENT DATA ON THE CHOLESTATIC SYNDROME. *(Fr.)* Frexinos, J. (Hopital Purpan, 31052 Toulouse, France). *Rev. Med. Toulouse* 10(16):491-501, 1974.

7771 ANOMALIES IN THE POSITION OF THE GALLBLADDER: REPORT OF ONE CASE. *(Fr.)* Pannier, M.; Leborgne, J.; Visset, J.; Barbin, J.-Y. (U.E.R. de Medecine, 1, rue Gaston-Veil, F. 44000, Nantes, France). *Arch. Anat. Pathol.* 22(4):267-270, 1974.

7772 PYLORIC STENOSIS, PRECURSOR OF GALLSTONE DISEASE. *(Ger.)* Lazarits, J.; Horvath, N.; Kuttel, P. (Ujpest Municipal Hosp., Budapest, Hungary). *Chirurg* 46(2):72-75, 1975.

7773 THE INFLUENCE OF INTERVENTION BY GASTRIC RESECTION ON THE PATHOGENESIS OF BILIARY DISEASE. *(It.)* Napolitano, A.; Di Curzio, B. (Istituto di III Clinico Chirurgica Dell' Universita di Roma, Rome, Italy). *Ann. Ital. Chir.* 47(5):439-455, 1975.

7774 MORPHOFUNCTIONAL STUDY OF THE LIVER AFTER GENTAMYCIN THERAPY IN CASES OF BILIARY TRACT INFECTION. *(It.)* Gasbarrini, G.; Miglio, F.; Bernardi, M.; Bonvicini, F.; Corazza, G. (Cattedra di Patologia Speciale Medica e Metodologia Clinica dell'Universita di Chieti, Italy). *Minerva Gastroenterol.* 20(3):83-89, 1974.

7775 THREE THOUSAND OPERATIONS FOR CHOLELITHIASIS. *(Fr.)* Rudler, J. C. (Clinique chirurgicale universitaire, Hopital Cantonal, 1211 Geneve 4, Switzerland). *Bull. Acad. Nat. Med. Paris* 158(9):783-786, 1974.

7776 CARCINOID TUMOR OF THE AMPULLA OF VATER: ANATOMICAL AND CLINICAL CONTRIBUTIONS. *(It.)* Spivach, A.; Tondi, D.; Domeniconi, R. (Istituto di Semeiotica Chirurgica dell'Universita di Trieste, Italy). *Arch. Ital. Chir.* 98(2):75-87, 1974.

7777 CONSIDERATIONS OF THE SYSTEMATIC USE OF PREOPERATIVE CHOLANGIOGRAPHY. *(It.)* Castelli, E.; Cuccarini, G.; Segagni, A. (Ospedale Maggiore di Milano, Italy). *Arch. Ital. Chir.* 98(2): 105-115, 1974.

7778 BILIARY PERITONITIS. A STUDY OF 23 CASES. *(Fr.)* Kayabali, I. (Fac. Med., Ankara, Turkey). *Lyon Chir.* 71(2):103-105, 1975.

7779 NOTES ON NEONATAL CHOLESTASIS. *(It.)* Ragazzini, F.; Bartolozzi, G.; Ciampolini, M. (Pediatr. Clinic, Univ. Florence, Florence, Italy). *Minerva Pediatr.* 26(34):1701-1722, 1974.

7780 FREE AMINO ACID CONTENT IN THE SERUM OF CHILDREN WITH CHRONIC DISEASES OF THE BILE DUCTS. *(Ukr.)* Tiazhka, O. V. (Kiev Medical Inst., Kiev, USSR). *Pediatr. Akush. Ginekol.* 37(2):26-27, 1975.

7781 THE SPECTRUM OF FREE AMINO ACIDS IN THE SERUM AND URINE OF CHILDREN WITH CHRONIC DISEASES OF THE BILE DUCTS. *(Rus.)* Krylova, T. V. (Lvov Medical Inst., Lvov, USSR). *Pediatr. Akush. Ginekol.* 37(2):24-26, 1975.

7782 BILE REFLUX GASTRITIS: VALUE OF ENDOSCOPIC CRITERIA. *(E.)* Goldner, F.; Worth Boyce, H. (Walter Reed Army Med. Cent., Washington, D.C.). *Gastroenterology* 68(4):1030, 1975.

7783 ENDOSCOPIC RETROGRADE CHOLANGIOGRAPHY IN THE DIAGNOSIS OF SCLEROSING CHOLANGITIS. *(E.)* Garabedian, M. M.; Richmond, M.; Gertler, A. (Lahey Clin. Found., Boston, Mass.). *Gastroenterology* 68(4):1029, 1975.

7784 POSTOPERATIVE RETAINED CHOLEDOCHOLITHIASIS: PERCUTANEOUS ENDOSCOPIC EXTRACTION. *(E.)* Sherman, H. I.; Margeson, R. C.; Davis, Jr., R. C. (Crawford W. Long Mem. Hosp., Atlanta, Ga.). *Gastroenterology* 68(4):1024, 1975.

7785 ENDOSCOPIC RETROGRADE CHOLANGIOGRAM (ERC) IN THE EVALUATION OF NON-JAUNDICED PATIENTS WITH BILIARY TYPE SYMPTOMS. *(E.)* Belsito, A. A.; Marta, J. B.; Dickinson, P. B.; Pizinger, R. J. (Bethesda Lutheran Hosp., St. Paul, Minn.). *Gastroenterology* 68(4):1018, 1975.

7786 VARIATIONS IN SERUM AND URINARY BILE ACID PATTERNS IN PATIENTS WITH CHOLESTASIS. *(E.)* Ven Berge Henegouwen, G. P.; Brandt, K. H.; Eyssen, H.; Parmentier, G. (Munic. Hosp., Arnhem, The Netherlands). *Gastroenterology* 68(4):1005, 1975.

7787 A COMPARISON OF THE METAL COMPOSITION OF CHOLESTEROL (CS) AND PIGMENT (PS) GALLSTONES AND SURROUNDING BILES. *(E.)* Sanchez, H. M. (Hosp. Univ. Pennsylvania, Philadelphia, Pa.). *Gastroenterology* 68(4):1003, 1975.

7788 THE VALUE OF OPERATIVE CHOLEDOCHOSCOPY IN THE MANAGEMENT OF BILIARY TRACT NEOPLASMS. *(E.)* Johnson, J.; Tompkins, R. (UCLA Sch. Med., Los Angeles, Calif.). *Gastroenterology* 68(4):1000, 1975.

7789 EFFECT OF ENTERIC HORMONES ON THE HUMAN SPHINCTER OF ODDI. *(E.)* Nebel, O. T. (Naval Regional Med. Cent., San Diego, Calif.). *Gastroenterology* 68(4):962, 1975.

7790 FEASIBILITY OF LOW DOSE AND INTERMITTENT CHENODEOXYCHOLIC ACID THERAPY OF GALLSTONES. *(E.)* Marks, J.; Bonorris, G.; Chung, A.; Coyne, M.; Goldstein, L.; Okun, R.; Schoenfield, L. (Cedars-Sinai Med. Cent., Los Angeles, Calif.). *Gastroenterology* 68(4):946, 1975.

7791 THE MECHANISM OF INCREASED GALLSTONE FORMATION IN OBESE HUMAN SUBJECTS. *(E.)* Mabee, T.; DenBesten, L.; Meyer, P.; Mason, E. (Univ. Iowa Coll. Med., Iowa City, Iowa). *Gastroenterology* 68(4):939, 1975.

7792 TREATMENT OF RETAINED COMMON BILE DUCT STONES BY INTRADUCTAL INFUSION OF A CHOLATE SOLUTION: A CONTROLLED TRIAL. *(E.)* LaRusso, N. F.; Thistle, J. L.; Hofmann, A. F.; Fulton, R. E. (Mayo Clin., Rochester, Minn.). *Gastroenterology* 68(4):932, 1975.

7793 MULTIPLE PERFORATIONS OF THE GALLBLADDER DURING CHOLELITHIASIS. *(Pol.)* Buslik, M.; Kozak, E.; Sudot, S. (L. Rydyger Municipal Hosp., 50-248 Wroclaw, Poland). *Wiad. Lek.* 27(8):733-735, 1974.

7794 INDICATIONS FOR DRAINAGE OF THE COMMON BILE DUCT VIA THE STUMP OF THE CYSTIC DUCT. *(Rus.)* Postrelov, N. A.; Mets, A. G. (Leningrad Medical Inst. Sanitation Hygiene, USSR). *Sov. Med.* (2):109-112, 1975.

7795 ASSESSMENT OF HEPATOBILIARY FUNCTION IN YOUNG SCHOOL-AGE CHILDREN WITH CHRONIC CHOLECYSTITIS. *(Rus.)* Sitnichenko, E. P. (Perm Medical Inst., USSR). *Pediatriia* (3):36-44, 1975.

7796 INTRAVENOUS CHOLEGRAPHY IN THE ASSESSMENT OF THE BILIARY SYSTEM IN CHILDREN WITH BILIARY DISEASE. *(Rus.)* Ipatov, Y. P.; Mikheeva, S. M. (Gorki Res. Inst. Pediatrics, USSR). *Pediatriia* (3):42-44, 1975.

7797 SOME BIOCHEMICAL INDICES OF THE BILE COMPOSITION IN DISEASES OF THE BILIARY TRACT IN CHILDREN. *(Rus.)* Donde, S. M. (Kiev Res. Inst. Pediatrics, Obstetrics, Gynecology, USSR). *Pediatriia* (3):34-36, 1975.

7798 VITAMIN A AND CAROTENE LEVELS IN THE BLOOD OF CHILDREN WITH Giardia-INDUCED CHOLECYSTITIS. *(Rus.)* Mingbaeva, N.; Dekhkan-Khodzhaeva, N. A.; Askarov, K. A. (L. M. Isaev Uzbek Res. Inst. Medical Parasitology, USSR). *Vopr. Pitan.* (1):20-21, 1975.

7799 BOTRYOID SARCOMA OF THE COMMON BILE DUCT. *(Fr.)* Gout, J. P.; Pont, J.; Pasquier, B.; Sarrazin, R.; Rossginol, A. M.; Roget, J. (Clinique Medicale Infantile, Centre Hospitalier Regional de Grenoble, 38700 La Tronche, France). *Pediatrie* 29(7):689-702, 1974.

7800 DISEASE OF THE SPHINCTER OF ODDI: CONSIDERATION OF A SERIES OF 203 CASES. *(Fr.)* Nigri, G.; Balestrazzi, N. (Surgical Polyclinic, Bari, Italy). *Lyon Chir.* 71(2):93-96, 1975.

7801 INDICATIONS FOR CHOLECYSTOSTOMY IN ELDERLY PATIENTS IN THE LIGHT OF SHORT AND LONG-TERM RESULTS. *(Rus.)* Belskii, A. V.; Safronov, A. V.; Denisiuk, E. I. (Saratov Medical Inst., USSR). *Sov. Med.* (2):106-108, 1975.

7802 1272 OPERATIONS FOR GALLSTONES IN THE COMMON BILE DUCT: II--AN IDEAL PROCEDURE WITH AN APPROACH THROUGH THE CYSTIC DUCT. *(Fr.)* Mallet-Guy, P. (No affiliation given). *Lyon Chir.* 71(1):9-20, 1975.

7803 POSTOPERATIVE ACALCULOUS CHOLECYSTITIS. *(Dan.)* Gravgaard, E. (Aarhus Hosp., Aarhus, Denmark). *Ugeskr. Laeg.* 137(14):798-800, 1975.

7804 POLYPS IN THE GALLBLADDER: TWO CASES. *(Fr.)* Arnaud, J. P.; Cinqualbre, J.; Weill-Bousson; Warter, P.; Forster, E. (Univ. Hosp. Center, Strasbourg, France). *Rev. Fr. Gastroenterol.* (104):43-46, 49-51, 1974.

7805 DIAGNOSIS FOR SPONTANEOUS INTERNAL BILIARY FISTULA. *(Jpn.)* Motoyama, H.; Nakagawa, H.; Ichinose, H.; Kobayashi, S.; Miyagawa, T.; Kidokoro, T.; Kurosawa, A.; Takagi, T.; Ishibashi, Y. (Juntendo Univ. Medical Sch., Japan). *Rinsho Hoshasen* 19(11):829-840, 1974.

7806 THE RADIOLOGICAL DIAGNOSIS OF HYPERPLASTIC CHOLECYSTOSIS. *(Ger.)* Uhlich, F.; Stobbe, G. (Friedrichshain Municipal Hosp., Berlin, Germany). *Radiol. Diagn.* 15(4):453-458, 1974.

7807 CLINICAL AND RADIOLOGICAL STUDY OF A DRUG THAT ACTS SELECTIVELY ON THE BILIARY TRACT. *(Fr.)* Dayras, M. (Laennec Hosp., Paris, France). *Ann. Gastroenterol. Hepatol.* 10(6):543-546, 1974.

7808 GALLBLADDER NECROSIS OCCURRING AFTER RETROGRADE PER-DUODENOSCOPIC CHOLANGIOGRAPHY. REPORT OF ONE CASE. *(Fr.)* Heully, F.; Gaucher, P.; Jeanpierre, R.; Laurent, J. (Brabois Hosp., Vandoeuvre, France). *Ann. Gastroenterol. Hepatol.* 10(6):471-474, 1974.

7809 TWO CASES OF GRANULAR CELL MYOBLASTOMA IN THE BALLBLADDER. *(Jpn.)* Ohnishi, H.; Yasumura, K.; Fukai, S.; Ro, T.; Utunomiya, T.; Uemura, T.; Tokugawa, H.; Hosoda, Y. (Okura Natl. Hosp., Okura, Japan). *Gan No Rinsho* 21(3):230-234, 1975.

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7811 CARCINOMA OF THE GALLBLADDER. A REVIEW OF 58 CASES. *(It.)* Dellepiane, M.; Ceresa, L.; Graziano, L.; Rognoni, M.; Invernizzi, G. G. (Ospedale Maggiore della SS, Carita di Novara, Italy). *Osped. Itl. Chir.* 27(5):261-266, 1974.

7812 PAPILLOSTOMY AS AN ALTERNATIVE TO CHOLEDOCHODUODENOSTOMY—LONG-TERM RESULTS. *(It.)* Carboni, M.; Patrassi, N.; De Bernardinis, G.; Negro, P.; Basoli, A.; Loriga, P. (Patologia Speciale Chirurgia, Universita de l'Aquilla, Aquilla, Italy). *Chir. Gastroenterol.* 8(4):433-438, 1974.

7813 RESULTS OBTAINED WITH HEPATICOJEJUNOSTOMY IN SURGERY OF THE MAIN BILE DUCT. *(It.)* Stefanini, P.; Carboni, M.; Patrassi, N.; Basoli, A.; De Bernardinis, G.; Negro, P. (Clinica Chirurgia, Universita di Roma, Rome, Italy). *Chir. Gastroenterol.* 8(4):426-432, 1974.

7814 INDICATIONS FOR RE-IMPLANTATION OF THE GALLBLADDER AND THE RESULTS OBTAINED. *(It.)* Milani, R.; Di Franco, S.; Impagliazzo, A. (Ospedale Civile, 07024 La Maddalena, Sassari, Italy). *Minerva Chir.* 30(6):306-310, 1975.

7815 STUDIES ON CHEMICAL COMPOSITION OF BILE IN CLINICAL AND EXPERIMENTAL CASES OF CHOLESTEROSIS OF THE GALLBLADDER. *(Jpn.)* Tinen, Y. (First Dept. Surgery, Univ. Kyushu, Fukuoka, Japan). *Fukuoka Acta Med.* 65(11):801-832, 1974.

7816 CHOLEDOCHOSCOPY: CLINICAL EVALUATION OF FOUR YEARS' EXPERIENCE. *(Por.)* Nishimura, A.; Iwasaki, Y.; Hiura, T. (Chiba Cancer Center Hospital, Chiba, Japan). *Arq. Gastroenterol.* 12(1): 13-20, 1975.

7817 LEIOMYOMA OF THE AMPULLA OF VATER (CLINICAL STUDY). *(It.)* Gagni, G.; Rossi, C.; Grazia, M.; Rosa, G. (Istituto di Patologia Speciale Chirurgia dell'Universita di Padova, Padova, Italy). *Acta Chir. Ital.* 30(4):423-429, 1975.

7818 RECENT VIEW ON THE PATHOGENESIS OF BILIARY CALCULI. *(It.)* Sianesi, M.; Lampugnani, R. (Istituto di Patologica Speciale dell'Universita di Parma, Parma, Italy). *Acta Chir. Ital.* 31(1):1-15, 1975.

7819 PERSONAL EXPERIENCE IN THE SURGICAL MANAGEMENT OF 20 CASES OF PAPILLO-ODDITIS FOLLOWING CHOLELITHIASIS. *(It.)* Scognamiglio, F.; Porcaro, B.; Ugolini, U. (S. Biagio Hosp., Bergamo, Italy). *Minerva Chir.* (1-2):27-46, 1975.

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7821 LITHOGENOUS BILE AND CHOLELITHIASIS. *(Ger.)* Stiehl, A. (Medizinischen Universitatsklinik, Heidelburg, Germany). *Fortschr. Med.* 93(7):343-344, 1975.

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7824 SPHINCTEROTOMY. *(E.)* Lubbers, E. J. C.; Bilski, R. (St. Radboud Hosp., Nijmegen, Netherlands). *Arch. Chir. Neerl.* 27(2):123-131, 1975.

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7826 BILE SALTS AND GALLSTONE DISEASE. *(E.)* Mackay, C. (Univ. Dept. Surg., Western Infirmary, Glasgow, Scotland). *Br. J. Surg.* 62(7): 505-512, 1975.

7827 FATAL Clostridium welchii SEPTICAEMIA FOLLOWING ACUTE CHOLECYSTITIS. *(E.)* Clancy, M. T.; O'Brian, S. (Federated Dublin Voluntary Hosp., Dublin, Ireland). *Br. J. Surg.* 62(7): 518-519, 1975.

7828 LEFT-SIDED GALLBLADDER: CALCULOUS CHOLECYSTITIS WITH SITUS INVERSUS. *(E.)* Southam, J. A. (Epsom District Hosp., Epsom, Surrey, England). *Ann. Surg.* 182(2):135-137, 1975.

7829 ADVANTAGES OF THE PROCEDURE BY TERMINAL IMPLANTATION OF THE BILIAR DUCT IN THE INDICATIONS OF BILIO-DIGESTIVES ANASTOMOSIS FOR INFLAMMATORY STENOSIS INDUCED BY LITHIASIS. *(E.)* Salembier, Y. (Clin. Louviere, Lille, France). *Chir. Gastroenterol.* 8(4):299-303, 1974.

7830 ACUTE RENAL FAILURE IN SURGICAL DISEASES OF THE LIVER AND BILE DUCTS. *(E.)* Toader, C.; Acalovschi, I.; Toader, I.; Ban, A. (Faculty Medicine, Cluj, Romania). *Chir. Gastroenterol.* 8(4):304-313, 1974.

7831 ABOUT ONE CASE OF CYSTIC DILATATION OF THE COMMON BILE DUCT. *(E.)* Dubois, J. (Hosp. Ougre, Belgium). *Chir. Gastroenterol.* 8(4):314-321, 1974.

7832 ZONOGRAPHY IN THE DIAGNOSIS OF POORLY VISUALIZED OR NON-FILLING GALL-BLADDER IN PERORAL CHOLECYSTOGRAPHY. *(E.)* Koivisto, E.; Lahde, S.; Nuutinen, J. (Univ. Oulu, Dept. Diagnostic Radiology, SF-90220 Ouou 22, Finland). *Aust. Radiol.* 18(4):412-414, 1974.

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7834 T-TUBE CHOLANGIOGRAPHY WITH BARIUM AFTER REACTION TO IODINATED CONTRAST MEDIUM. *(E.)* Wolfman, N. T.; Short, W. F. (Presbyterian-Univ. Hosp., Univ. of Pittsburgh, Pittsburgh, Pa. 15261). *JAMA* 232(5):523-524, 1975.

7835 INFLUENCE OF CHOLEDOCHOSCOPY ON THE CHOICE OF SURGICAL PROCEDURE. *(E.)* Schein, C. J. (Montefiore Hosp., Bronx, N.Y.). *Am. J. Surg.* 130:74-77, 1975.

7836 RECURRENT WOUND SINUSES AFTER CHOLECYSTECTOMY FOR Salmonella paratyphi. *(E.)* Tuononen, S.; Klintrup, H.-E.; Mokka, R. (Dept. Surgery, Univ. Oulu, Oulu, Finland). *Ann. Chir. Gynaecol. Fenn.* 64(1):22-23, 1975.

7837 VARIETIES OF SCLEROSING CHOLANGITIS. SURGICAL SIGNIFICANCE. *(E.)* Grodsinsky, C.; Block, M. A.; Brush, B. E. (Henry Ford Hosp., 2799 W. Grand Blvd., Detroit, Mich. 48202). *Bull. Soc. Int. Chir.* 33(3):187-195, 1974.

7838 COMPARATIVE RESULTS OF PAPILLOSTOMY AND CHOLEDOCHO-DUODENOSTOMY FOR LITHIASIS OF THE COMMON BILE DUCT. *(E.)* Fegiz, G.; Tonelli, F. (Istituto di Patologia Chirurgie 2, Univ. Roma, Rome, Italy). *Surg. Italy* 4(1):54-61, 1974.

7839 UPPER ABDOMINAL MASS ASSOCIATED WITH JAUNDICE: A RARE FORM OF PANCREATIC PSEUDOCYST PRESENTATION. *(E.)* Djadalizadeh, M.; Flemming II, A. B. C.; Lau, S. C. K.; Bonnabeau, Jr., R. C. (West Virginia Univ. Sch. Medicine, Morgantown, W. Va.). *W. Va. Med. J.* 71(6):133-134, 1975.

7840 EIGHT HUNDRED CHOLECYSTECTOMIES. A PLEA FOR MANY FEWER DRAINS. *(E.)* Ross, F. P.; Quinlan, R. M. (Burbank Hosp., Fitchburg, Mass.). *Arch. Surg.* 110(6):721-724, 1975.

7841 FLOW THROUGH THE BILE DUCT AFTER CHOLECYSTECTOMY. *(E.)* Scott, G. W.; Smallwood, R. E.; Rowlands, S. (Div. Surgery Biophysics, Univ. Calgary, Calgary, Alberta, Canada). *Surg. Gynecol. Obstet.* 140(6):912-918, 1975.

7842 TRENDS IN SURGICAL TREATMENT OF CALCULOUS DISEASE OF THE BILIARY TRACT. *(E.)* Glenn, F. (no affiliation given). *Surg. Gynecol. Obstet.* 140(6):877-884, 1975.

See also, 6993, 6994, 7000, 7011, 7021, 7027, 7033, 7061, 7067, 7068, 7100, 7114, 7169, 7267, 7305, 7306, 7307, 7336, 7341, 7523, 7530, 7554, 7568, 7589, 7619, 7643, 7688, 7724, 7946, 7961.

## GENERAL

7843 CALCIUM-BINDING PROTEIN IN THE DUODENAL MUCOSA OF UREMIC PATIENTS AND NORMAL SUBJECTS. *(E.)* Piazolo, P.; Hotz, J.; Helmke, K.; Franz, H. E.; Schleyer, M. (Dept. für Innere Medizin, Universitat Ulm, Steinhövelstrasse 9, D 79 Ulm (Donau), Federal Republic Germany). *Kidney Int.* 8(2):110-118, 1975.

The content and localization of a specific calcium-binding protein in intestinal biopsy specimens were

determined by immunological techiques in patients with terminal renal insufficiency and in normal controls. Of the 18 patients, nine had chronic glomerulonephritis in renal failure, one had rapidly progressive glomerulonephritis in renal failure, and eight were free of renal or gastrointestinal disorders. The control group of eight patients had functional gastrointestinal complaints. Highly purified calcium binding protein was obtained from normal human renal tissue, and a specific antiserum was prepared. Intestinal biopsies were ultrasonically homogenized, centrifuged, and the specific activity of the calcium binding protein was determined from the supernatant. An antiserum-agar gel mixture was made and incubated with antigen-containing material extracted from the biopsy specimens. To determine the site of the protein in the mucosa, frozen sections were made and overlaid with rabbit antisera and goat anti-rabbit gamma globulin conjugated with fluorescinisothiocyanate and were studied by fluorescence microscopy. In the eight healthy subjects, calcium-binding protein content was 10.80 µg/mg of protein in the supernatant from the biopsy material. In the uremic patients, there was a 67% reduction in content (3.65 µg/mg). In controls, specific immunological activity showed that the protein was distributed uniformly along the brush border and the basement membrane of the epithelial cells, and around and inside the goblet cells. In specimens from the uremic patients, the protein was localized nonhomogeneously in the brush border area, in the goblet cells and intensively along the basement membrane. In comparison to controls, fluorescence was reduced or absent in the brush border area. It is concluded that the calcium-binding protein was reduced in concentration in the intestinal mucosa of uremic patients, particularly along the brush border area.

7844 FOOD ANTIBODIES IN MALNUTRITION. *(E.)* Chandra, R. K. (All India Inst. Medical Sciences, New Delhi, India). *Arch. Dis. Child.* 50(7): 532-534, 1975.

The presence of blood antibodies to food antigens and the titer and immunoglobulin (Ig) class of these antibodies were investigated in 20 malnourished children, aged six to 30 months. None of the children had gastroenteritis at the time of blood sampling. Tests were done on admission and after seven to 10 days of hospital stay during which period the children received a diet containing milk, wheat, rice, egg, meat, vegetables, legumes. Another set of 20 age-sex matched healthy children served as controls. Sera were tested against milk proteins, gluten, egg proteins, and sheep serum by microdouble immunodiffusion and the tanned sheep RBC hemagglutination method. Antibodies to several food proteins were detected in the serum of 13/20 malnourished children. Antibody activity was found mainly in the IgG and IgA class. On ingestion of food items to which antibodies were demonstrated, no untoward symptom occurred nor was complement activation observed *in vivo*. It is suggested that food antibodies in malnourished children result from atrophied gut mucosa and reduced secretory immune response, which permit passage of intact or incompletely digested protein molecules, and impaired phagocytic function of hepatic reticuloendothelial system. Such antibodies do not appear to play any immediate immunopathological role.

7845 THE SMALL BOWEL IN IMMUNOGLOBULIN DEFICIENCY SYNDROMES. *(E.)* Marshak, R. H.; Hazzi, C.; Lindner, A. E.; Maklansky, D. (Mount Sinai Sch. Medicine, City Univ. New York, N.Y.). *Am. J. Gastroenterol.* 64(1):59-72, 1975.

A classification system and the description of roentgenographic features of various immunoglobulin (Ig) deficiency syndromes (due to a deficiency in B-cell number or function) with gastrointestinal manifestations are presented. Such deficiencies may be primary or secondary to a variety of diseases. Roentgenographic manifestations of the enteropathic Ig deficiency syndromes were organized in four groups. Sprue (malabsorption) pattern, as seen in hypogammaglobulinemia sprue and IgA-deficient sprue, was characterized by dilations of the small bowel, segmentation, fragmentation of the barium column, and hypersecretion. The second group included multiple nodular defects of variable Ig deficiencies in association with giardiasis (*Giardia lamblia* infection) of the stool, isolated IgA deficiency, and lymphosarcoma; characterized by a uniform distribution of innumerable tiny, smooth, nodular filling defects (1-3 mm in diameter) throughout the involved intestinal segment. Inflammatory changes secondary to giardiasis, the third category, were usually limited to the duodenum and jejunum and were associated with spasms, irritability, slight narrowing of the lumen with thickening and distortion of the folds. The presence of *Giardia lamblia* in the stool did not necessarily indicate an abnormal small bowel roentgenogram. The fourth classification, thickening of the small intestinal folds, was a feature of secondary Ig disorders as seen in amyloidosis, lymphosarcoma, plasma cell dyscrasias, intestinal lymphangiectasia, and possibly *alpha chain disease*. Recent advances in immunology have permitted the construction of a classification system for various Ig deficiency states associated with gastrointestinal manifestations, which is dependent upon their roentgenographic features.

7846 ABDOMINAL LYMPHOMA WITH α-HEAVY CHAIN DISEASE. *(Eng.)* Plesnicar, S.; Sumi-Kriznik, T.; Golouh, R. (Inst. Oncology, Ljubljana, Yugoslavia). *Israel J. Med. Sci.* 11(8):832-837, 1975.

A 27-yr-old man was presented with abdominal lymphoma, malabsorption syndrome, 20-kg weight loss, and the presence of α-heavy chains in the serum; this was the first such case observed in Yugoslavia. Clinical, immunochemical and pathological studies were performed. X-ray examinations revealed changes of the gastrointestinal tract consistent with malabsorption syndrome; $^{131}I$ oleic acid test demonstrated impaired intestinal fat absorption; laparotomy disclosed enlarged lymph nodes adjacent to duodenum and in the mesentery, and gave an evaluation of chronic lymph-

adenitis. Immunoelectrophoresis revealed α-heavy chains in the patient's serum, urine and intestinal fluid. Treatment with cyclophosphamide and corticosteroids produced an improvement in the patient's condition. He survived 18 mo after the onset of symptoms. Autopsy revealed a malignant lymphoma of mixed histiocytic-lymphocytic type involving the mesenteric lymph nodes primarily and also the jejunal mucosa, liver, spleen, and extraabdominal lymph nodes. It was assumed that the early stage of the disease was benign in character, but later became generalized with hepatosplenomegaly. This case is a further example of abdominal lymphoma complicated with α-heavy chains in serum reported from the Mediterranean area; etiologic factors (e.g., genetic tracts, food habits, intestinal infections, and climatic conditions) should be considered.

7847 MIGRATION OF PERIPHERAL LEUKOCYTES IN THE PRESENCE OF CARCINOEMBRYONIC ANTIGEN. STUDIES IN PATIENTS WITH CHRONIC INFLAMMATORY DISEASES OF THE INTESTINE AND CARCINOMA OF THE COLON AND PANCREAS. *(E.)* Straus, E.; Vernace, S.; Janowitz, H.; Paronetto, F. (Mount Sinai Sch. Medicine, City Univ. New York, N.Y. 10229). *Proc. Soc. Exp. Biol. Med.* 148(2):494-497, 1975.

An *in vitro* correlate of cell-mediated immunity was used to study the response of purified carcinoembryonic antigen (CEA) in patients with conditions associated with the antigen. The patients included four with adenocarcinoma of the colon, four with carcinoma of the pancreas, four with active ulcerative colitis, 10 with Crohn's disease, and five normal subjects. The leukocyte migration test was performed using CEA prepared from a large hepatic metastasis of a colonic adenocarcinoma. Antigen prepared from normal adult colonic mucosa was also used. Radioimmunoassays for circulating CEA were carried out. The results of the leukocyte migration test using each antigen in protein concentrations of 50 and 250 μg/ml showed no significant inhibition by CEA in patients with Crohn's disease, ulcerative colitis or gastrointestinal malignancies. One exception was a patient with pancreatic carcinoma, with circulating CEA levels of over 20 ng/ml. Circulating CEA levels were above 2.5 ng/ml in 10 patients and below 2.5 ng/ml in two patients after resection for carcinoma of the colon. These results indicate that an organ-specific cellular reactivity cannot be attributed to CEA. It is further suggested that the histologic abnormalities in ulcerative colitis and Crohn's disease are not the result of delayed hypersensitivity to CEA.

7848 TRANSPLANTATION OF HUMAN CANCERS TO NUDE MICE AND EFFECTS OF THYMUS GRAFTS. *(E.)* Schmidt, M.; Good, R. A. (Memorial Sloan-Kettering Cancer Center, 1275 York Ave., New York, N.Y. 10021). *J. Natl. Cancer Inst.* 55(1):81-87, 1975.

Efforts were made to transplant human malignant tissues of various origins, including the upper gastrointestinal tract, to male and female nude mice. The effects of thymus implantation to tumor-bearing animals was also studied. The human tumor cell lines used included: HUTU-80 isolated from an adenocarcinoma of the foregut; HS766 isolated from pancreatic adenocarcinoma; SK-Mel-5 isolated from melanoma; and WI-38 human embryonic lung fibroblasts. Surgical specimens of gastric adenocarcinomas, pancreatic adenocarcinomas, colon carcinomas, and malignant melanomas were also implanted in mice. Using HUTU-80, the tumors developed almost invariably within 1 week of inoculation, had exponential growth curves, and were able to reach half the size of their host within 60 days. HS766 produced a solid tumor nodule containing calcific foci at the site of injection. Linear growth rate, corresponding to the rate of its *in vitro* replication, was observed. SK-Mel-5 produced a tumor whose growth pattern was slow and linear, and one tumor produced melanin. Transplanted colon carcinoma grew at a rate similar to that of the HUTU-80 inoculates, whereas the development of the pancreatic implants was considerably slower, and that of the gastric adenocarcinoma and melanoma implants, externally inapparent. All tumors resembled the original neoplasm. Metastases were not observed. In one experiment, nine mice received thymus implants. Eight died spontaneously with decreased survival time. In nine other nude mice inoculated with HUTU-80, thymus implants caused tumor shrinkage, beginning after one month, and in four instances complete regression. These results represent the first known instance of successful transplantation of cell lines of human cancer of the foregut and pancreas to the nude mouse. The varying rates of growth of the tumors suggest that the rate of human xenograft development is controlled by endogenous cellular properties of the tumor rather than by a fundamental difference between the fate of inoculated tissue-cultured cell lines and that of surgical specimens. Models such as the nude mouse are particularly attractive because in them human tissues growing in a mammalian system can be used to develop chemotherapies and combination therapies directed toward human tumors themselves.

7849 ENTEROINVASIVE AND ENTEROTOXIGENIC *Escherichia coli*: OCCURRENCE IN ACUTE DIARRHEA OF INFANTS AND CHILDREN. *(E.)* Rudoy, R. C.; Nelson, J. D. (Univ. Texas Southwestern Medical Sch., 5323 Harry Hines Blvd., Dallas, Tex. 75235). *Am. J. Dis. Child.* 129(6):668-672, 1975.

The abilities of *Escherichia coli* to induce diarrhea by enterotoxin production and by intestinal cell penetration were investigated simultaneously in children with diarrheal disease. Thirty-six infants and children with acute diarrhea and 17 healthy children (age range, less than one yr to more than five yr) were studied. From each patient's rectal swab culture, *E. coli* colonies were tested for enterotoxin production by intragastric inoculation in suckling mice and screened for cell penetration with HEp-2 cells. Colonies showing invasiveness in HEp-2 cells were further tested by inoculation into guinea pig conjunctivae. *Salmonella* or *Shigella* strains were isolated from 42% of the patients with diarrhea. Enterotoxin-producing strains of *E. coli* were found in 86% of the diarrhea group and in 41% of the healthy controls. Strains with capability to invade epithelial cells were found in 30% of the diarrhea group and

in 12% of controls. In seven patients, *E. coli* strains demonstrated both enterotoxin production and invasiveness. Overall, bacteria capable of causing diarrhea (*Salmonella, Shigella,* and enteroinvasive or enterotoxigenic *E. coli*) were demonstrated in 94% of infants with diarrheal disease. However, the high frequency of enterotoxigenic strains in healthy controls suggests that in some patients with diarrhea there may be a coincidental carrier state with diarrhea actually due to another cause.

7850 INTESTINAL ABSORPTION, EXOCRINE PANCREATIC FUNCTION AND RESPONSE TO Vibrio cholerae INFECTION IN PROTEIN DEFICIENT PATAS MONKEYS (Erythrocebus patas). *(Eng.)* Gyr, K.; Felsenfeld, O.; Wolf, R. H. (Tulane Univ. Delta Primate Res. Center, Covington, La. 70433). *Trans. R. Soc. Trop. Med. Hyg.* 69(2):247-250, 1975.

The effects of *Vibrio cholerae* infection on intestinal and exocrine pancreatic functions were studied in male and female patas monkeys maintained for 11 to 13 wk on a protein-free diet prior to challange (by gavage) with 0.9 to 1.2 x $10^6$ *V. cholera* (Ogawa 41 strain). The serum proteins, albumin, globulin, and vibriocidal antibody titers were determined, the intestinal contents were collected through a double-lumen tube and analyzed for lipase, trypsin, and amylase, and the intestinal absorption of D-xylose and folic acid was estimated. After an average of 12.7 wk on the protein-free diet, the total serum protein dropped by 26.3%, albumin dropped by 34.2%, globulin dropped by 17.7%, and the average body weight loss was 17.4%. There was no significant change (compared with predieting values) in D-xylose absorption, but the absorption of folic acid decreased by 50.7%. Five of the six animals showed mean reductions in the intestinal trypsin, lipase, and amylase concentrations of 72.6%, 64.4%, and 94.8% resp.; the other animal showed minor reductions in all enzymes. The mean excretion time of the vibrios was 2.3 days in controls and 5.9 days in the animals on the protein-free diet. The monkey which showed little impairment in exocrine pancreatic function excreted vibrios for 2 days and did not develop diarrhea, whereas the other animals on the protein-free diet had diarrhea for an average of 1.7 days (one day in the controls). Serological test values did not vary between the experimental animals and controls except for the agglutination test, which yielded a higher titer 2 wk after challenge in the protein-depleted monkeys. The data suggest that circulating immunoglobulin production occupies a preferential status in protein synthesis.

7851 NECROTIZING ENTEROCOLITIS IN THE NEWBORN: OPERATIVE INDICATIONS. *(E.)* O'Neill, J. A.; Stahlman, M. T.; Meng, H. C. (Vanderbilt Univ. Sch. Medicine, Nashville, Tenn. 37232). *Ann. Surg.* 182(3):274-279, 1975.

A plan for management of infants with neonatal necrotizing enterocolitis is described, and criteria for surgical intervention are analyzed. There were 52 infants, the majority of whom were of premature and low birth weight. The mothers of 47 had premature rupture of the membranes, severe meconium staining of the amniotic fluid, or prolonged and difficult labor. There were severe respiratory distress and hypoxia in 70% of the cases. Criteria for diagnosis of the disease included postmortem or postoperative information, or clinical observations on the basis of physical signs plus radiographic findings of pneumatosis intestinalis. Initial symptoms and signs included: sudden temperature instability (usually hypothermia), ileus with gastric retention, vomiting of bilious and/or guaiac positive material, abdominal distention, and lethargy. In 60% of the cases the first sign of the disease was seen within the first 5 days of life. Once diagnosis was suspected, p.o. or i.v. feeding was stopped and orogastric drainage was instituted. The superior vena cava was catheterized, and 10% glucose plus electrolytes was infused, gradually being increased to 20% glucose plus crystalline amino acids. Nasopharyngeal, stool, urine, endotracheal, cerebrospinal fluid and serial blood cultures were obtained, and i.v. antibiotics were administered. Examinations and recumbent and left lateral decubitus x-rays were done every 8 hr. Significant ascites was treated by paracentesis and the fluid was cultured. The decision to operate was individually based on clear cut signs of perforation or continued physiologic deterioration. A sudden drop in serum sodium and metabolic acidosis of longer than 4 hr duration were accurate indications of clinical deterioration. A sudden drop in platelet count or lengthening of partial thromboplastin time or prothrombin time always indicated bowel gangrene or perforation. Of 32 infants treated by supportive therapy only, 22 survived. Of the ten that died, two were not subjected to surgery due to irreversible central nervous system damage. Of 20 surgically-treated infants, 12 survived. Two of the eight non-survivors had involvement of the entire gastrointestinal tract; six others may have survived if operated on earlier in the course of the disease. No specific conclusions are drawn.

7852 RECESSIVE INHERITANCE OF THE ADULT TYPE OF INTESTINAL LACTASE DEFICIENCY. *(E.)* Lisker, R.; Gonzales, B.; Daltabuit, M. (Instituto Nacional Nutricion, San Fernando y Viaducto Tlalpan, Mexico 22, D.F.). *Am. J. Hum. Genet.* 27(5):662-664, 1975.

The results of family studies performed in Mexico which corroborate that the inheritance of the adult type of lactase deficiency is controlled by a single recessive autosomal gene are presented. This corroboration is particularly important because the studies were performed in an ethnic group where lactase deficiency is frequent, which was not the case in the previous report. A total of 61 families with 177 children over six yr of age was investigated. All volunteered for the study and were not informed of its objective until completion of the tests so that milk drinking habits or intolerance symptoms would not influence the decision to cooperate in the investigation. To detect the presence of lactase deficiency, the lactose tolerance test was performed after an overnight fast. Each subject was given a

dose of lactose equal to 2 g/kg body weight, except that those over 25 kg received a standard dose of 50 g. The criterion for lactase deficiency was a maximum blood glucose rise of less than 20 mg/100 ml. When the blood glucose rise was between 20 and 24 mg/100 ml (found in six subjects), the presence of explosive diarrhea within six hr of performing the test was taken as indicative of deficiency. Snyder's ratios were used to analyze the data. The results strongly suggest that this deficiency is inherited as a simple Mendelian recessive trait. The data presented, showing no significant differences between observed and expected phenotypes among the offspring, except for the deficient X deficient matings, support the hypothesis that the deficient state is controlled by an autosomal gene pair.

7853 CONSTRICTIVE PERICARDITIS AND PROTEIN LOSING ENTEROPATHY: AN IMITATOR OF INTESTINAL LYMPHANGIECTASIA. *(E.)* Kumpe, D. A.; Jaffe, R. B.; Waldmann, T. A.; Weinstein, M. A. (Univ. Hosp., Baltimore, Md.). *Am. J. Roentgenol. Radium Ther. Nucl. Med.* 124(3):365-373, 1975.

The clinical and roentgenographic manifestations of constrictive pericarditis with secondary protein losing enteropathy are discussed and a typical case history is presented. A 14-year-old male suddenly developed abdominal cramps followed by frequent, explosive diarrhea. Examination revealed edema of the lower extremities and scrotum, a protuberant abdomen, Grade II/VI midsystolic murmur, hypocalcemia, a depressed mean lymphocyte count, anergy to multiple antigens, inability to reject a skin graft from an unrelated donor, and the characteristic cineangiocardiographic findings of constrictive pericarditis. A small bowel series showed the classic picture of intestinal lymphangiectasia which, along with the other signs and symptoms, had disappeared several months after removal of the pericardium from the anterior and lateral portions of the heart. In a series of four males and one female (2-32 yr of age) with the same disorder, edema was the major presenting complaint in all; only one patient manifested ascites. Anergy was present in one preoperatively and developed in a second patient 3.5 mo following pericardiectomy. The postulated mechanism in these cases was leakage of lymphocytes into the gastrointestinal lumen from the dilated lymphatics, producing lymphocytopenia and anergy. In four patients, the diagnosis of constrictive pericarditis was not suspected prior to extensive evaluation. In the four cases in which pericardiectomy was performed, there was a gradual return to clinical normality. The roentgenographic manifestations of the condition were essentially those of intestinal lymphangiectasia, and the gross and microscopic appearances of the small bowel were identical to those found in intestinal lymphangiectasia. The mechanism whereby protein losing enteropathy develops in constrictive pericarditis is not completely understood, but sustained systemic venous hypertension and relative thoracic duct obstruction appear to be involved. The time of recovery from the protein losing enteropathy following surgical correction of the constrictive pericarditis varies according to the pace of hemodynamic recovery. Constrictive pericarditis can be a subtle clinical entity and should be carefully excluded in all cases where gastrointestinal roentgenographic studies and intestinal biopsy indicate intestinal lymphangiectasia.

7854 ENTEROPATHY IN ADULT PROTEIN MALNUTRITION: A REVIEW OF THE CALI EXPERIENCE. *(E.)* Mayoral, L. G.; Bolanos, O.; Lotero, H.; Duque, E. (Universidad del Valle Sch. Medicine, Apartado Aereo 1013, Cali, Colombia, South America). *Am. J. Clin. Nutr.* 28(8):894-900, 1975.

A review of the clinical findings in 41 patients with severe, primary, strictly defined protein malnutrition is presented. All cases had a history of low protein intake of at least 4 mo duration. Mean serum levels upon admission were: hemoglobin, 8.35 g/ml; total protein, 5.05 g/100 ml; albumin, 1.7 g/100 ml; cholesterol, 105 mg/100 ml; vitamin $B_{12}$, 500 p/ml; folate, 5.3 ng/ml. The D-xylose excretion test showed malabsorption in over half of the patients. Fat excretion tests showed a minimal degree of steatorrhea. Liver biopsies showed the presence of hepatic steatosis of variable severity. Radiologic abnormalities of the small intestine were: slow transit lines, thickening and disorganization of intestinal folds, segmentation and moulage. The deficiency pattern described in gluten-induced enteropathy was not seen. With protein repletion as the sole therapeutic modality, a progressive improvement in nutritional state, amelioration of clinical signs and disappearance of radiologic abnormalities was observed. These findings provide further evidence that malabsorptive damage does not always occur with severe primary protein malnutrition.

7855 GASTROINTESTINAL INVESTIGATIONS IN DERMATITIS HERPETIFORMIS. *(E.)* Fausa, O.; Larsen, T. E.; Husby, G.; Thune, P. (Rikshospitalet, Oslo, Norway). *Acta Derm. Venereol. (Stockh.)* 55(3): 203-206, 1975.

The frequency and severity of gastric and intestinal abnormalities in dermatitis herpetiformis were studied in 37 patients (23 men and 14 women, aged 18-77 yr) with symptoms of six months to 40 yr duration. The following investigations were carried out: pentagastrin stimulation test (6 µg/kg, s.c.), secretin test, D-xylose absorption (25 g, p.o.), vitamin A absorption (350,000 IU), Schilling test for vitamin $B_{12}$ absorption, folic acid determinations in serum and whole blood, vitamin $B_{12}$ in blood, and jejunal and gastric biopsy. Vitamin A values were normal in 14 and low in 14 of 28 patients tested. Normal xylose absorption was seen in 12 and was low in 11 of 23. Vitamin $B_{12}$ in blood was normal in all but five cases of 28 tested. Folic acid in serum was normal in 15 and low in 14 of 29; and in whole blood normal in all but five cases of 19 tested. Histologic features characteristic of gastritis were seen in 14 of 28 patients; 12 of these had hypo- or achlorhydria. Hypo- or achlorhydria was also seen in five of eight cases with nonatrophic gastritis. Granular deposits of immunoglobulin A were present in the dermo-

epidermal junction of uninvolved skin in 23 patients. Jejunal biopsy showed marked villous atrophy in 17 of 37 patients (46%); 12 of the 37 had more moderate changes and normal mucosa was seen in eight cases. These results confirm previous findings of gastric and small intestinal changes in dermatitis herpetiformis patients.

7856 MUCO-EPIDERMOID TUMORS OF THE SALIVARY GLANDS: 30 OBSERVATIONS. *(Fr.)* Brocheriou, Cl.; Seghir, M. (Hopital de la Salpetriere, 75013, Paris, France). *Rev. Stomatol. Chir. Maxillofac.* 75(8):1039-1047, 1974.

7857 PROCEEDINGS IN THE OPERATIVE TREATMENT OF GASTROINTESTINAL DISEASES. *(Ger.)* Schwemmle, K. (Surg. Clin., Univ. Erlangen-Nurnberg, Germany). *Fortschr. Med.* 93(5):226-230, 1975.

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7936 TOTAL FAT EXCRETION IN MECONIUM AND FAECES OF NEWBORNS MEASURED BY A NEW METHOD OF HIGH CLINICAL USEFULNESS. *(Pol.)* Tomaszewski, L.; Hofman, H.; Koscielska, M. (Z. Zakladu Analityki Klinicznej Instytutu Biofarmecji AM w Warszawie, Poland). *Pediatr. Pol.* 50(5):545-556, 1975.

See also, 6990, 6995, 6996, 7023, 7026, 7034, 7042, 7052, 7100, 7112, 7212, 7222, 7326, 7327, 7369, 7557, 7583, 7703, 7938.

## GENERAL

### Parasitology

7937 CLINICAL TRIAL OF MEBENDAZOLE, A BROAD-SPECTRUM ANTHELMINTHIC. *(E.)* Hutchison, J. G. P.; Johnston, N. M.; Plevey, M. V. P.; Thangkhiew, I.; Aidney, C. (East Birmingham Hosp., Birmingham B9 5 ST, England). *Br. Med. J.* 2(5966):309-310, 1975.

Results are presented for a clinical trial of mebendazole in 85 children (aged 5-14 yr) with helminths. Mebendazole (200 mg/day for three days) was administered to all children with helminth ova detected by the formol-ether method. A second fecal specimen was obtained from seven to 21 days later, and any toxic effects determined. Of the 85 children, 65 (76%) appeared on the second examination to have been dewormed. In those with a single infestation, the cure rates were: ascaris, 100%; trichuris, 91%; hookworm, 94%; and hymenolyepis, 50%. All four children with ascaris and trichuris were cured, as were all three with ascaris, trichuris and hookworm. Of three with ascaris and hookworm, one was cured, and of the three with trichuris and hookworm, one was cured. Of seven children with hookworm and hymenolepis, only one was cured. Of 25 single infestations with *Giardia lamblia* cysts, 10 (40%) were cured. There was no evidence of drug toxicity. It is concluded that mebendazole is useful for treating multiple infestations in the United Kingdom.

7938 INCIDENCE OF INTESTINAL OBSTRUCTION IN CHILDREN INFECTED WITH Ascaris lumbricoides. *(Eng.)* Blumenthal, D. S.; Schultz, M. G. (U. S. Dept. Health, Education and Welfare, Atlanta, Ga. 30333). *Am. J. Trop. Med. Hyg.* 24(5):801-805, 1975.

The incidence of intestinal obstruction in children with *Ascaris lumbricoides* infection was estimated in the southeast United States, an ascariasis endemic area. Data were collected from ascariasis patients discharged from three rural southern Louisiana public hospitals from 1970 to 1973. Obstruction was defined as *Ascaris* infection plus three or more of the following clinical findings: vomiting, constipation for at least 24 hr, abdominal distention, a palpable abdominal mass, abnormal bowel sounds and radiographic findings. The prevalence of ascariasis in the three counties was calculated from 2,360 stool examinations performed by the State Health Dept. and by one hospital laboratory. Twenty-one patients (age range, 10 mo-14 yr) were hospitalized with complete or partial intestinal obstruction secondary to ascariasis during the 3-yr test period. Prevalence rates for younger and older children were similar, but the majority of intestinal obstruction was found in children, 1 to 5 yr of age (85%). There was no significant difference in rates of infection by sex. Prevalence rates were three times higher among blacks (19 of 21 cases). Thus, the incidence of intestinal obstruction was highest in children in the 1-5 yr age group, and approximated two obstructions/1000 infected children/6 yr.

7939 EOSINOPHILS AS MEDIATORS OF ANTIBODY-DEPENDENT DAMAGE TO SCHISTOSOMULA. *(E.)* Butterworth, A. E.; Sturrock, R. F.; Houba, V.; Mahmoud, A. A. F.; Sher, A.; Rees, P. H. (Wellcome Trust Res. Lab., PO Box 43640, Nairobi, Kenya). *Nature* 256(5520):727-729, 1975.

The release of $^{51}Cr$ from labeled *Schistosoma mansoni* larvae was used to measure damage to schistosomula by peripheral blood leukocytes from the heparinized blood of uninfected laboratory workers and from the heat-inactivated sera from five patients infected with *S. mansoni*. Isotope release was proportional to the logarithm of the effector to target ratio over a range of ratios from 50:1 to 5,000:1. Subsequent attempts to purify the effector cell showed that the cytotoxic

activity was progressively lost during repeated cycles of incubation with carbonyl iron and subsequent magnetic extraction. Furthermore, after centrifugation of the starting effector cell preparation over Ficoll-Hypaque, the cells recovered from the pellet were ten-fold more active than those recovered from the interface. The pellet preparation contained 88% polymorphonuclear cells (PMN) and 12% mononuclear cells (MN), whereas the interface contained 9% PMN and 91% MN. Thus, it appeared that the active cell was a member of the PMN series. Unpurified effector cells were treated with antihuman eosinophil serum (AES) or antihuman neutrophil serum (ANS) and complement and were subsequently titrated for antibody-dependent cytotoxicity to schistosomula. Isotope release was related to the number of viable eosinophils, but not to the number of viable neutrophils. Cells from three patients with marked eosinophilia induced by schistosomiasis or other helminth infections did not show the increase in cytotoxic activity which would be predicted if all eosinophils were equally active, however. The data indicate that the major, and possibly the only, cell type in normal human peripheral blood capable of inducing antibody-dependent, complement-independent damage to schistosomula is the eosinophil.

7940 THE *Schistosoma japonicum* EGG GRANULOMA. *(E.)* Warren, K. S.; Boros, D. L.; Hang, L. M.; Mahmoud, A. A. F. (Dept. Medicine, Case Western Reserve Univ., Cleveland, Ohio 44106). *Am. J. Pathol.* 80:279-294, 1975.

The early response to *Schistosoma japonicum* eggs in the livers of infected (*via* placement of ten cercariae on the shaved abdominal skin, female Swiss mice was studied, as was the reaction to 2000 eggs injected into the pulmonary arterioles of previously exposed (2-7 wk earlier) and unexposed mice. In other experiments, 2000 eggs were injected, i.v., into mice which had been sensitized 2 wk previously with i.p. or s.c. soluble egg antigens (SEA), s.c. SEA with complete Freund's adjuvant, s.c. eggs (3,000), or s.c. eggs with complete Freund's adjuvant. In animals with light *S. japonicum* infections, the livers contained 36,000 eggs 5 wk after infection (2 weeks after the beginning of egg production), but there was no histopathological reaction to the eggs nor any evidence of hepatosplenic disease. By 6 wk after infection, however, large abscesses replete with eosinophils were found around some of the eggs and there was noticeable periportal inflammation consisting predominantly of plasma cells. After 6 wk, major lesions were noted primarily around large aggregates of eggs, and hepatosplenomegaly and portal hypertension were observed. Living *S. japonicum* eggs injected into the pulmonary microvasculature of previously unexposed mice did not evoke significant granulomatous reactions on either primary or secondary exposure. Even when the eggs were injected into the lungs of infected animals, which had large granulomas around egg aggregates in the liver, little or no inflammatory reaction was seen around the eggs distributed singly throughout the pulmonary vessels. When a priming dose of eggs or SEA was injected, s.c., with or without Freund's adjuvant, however, significant granuloma formation occurred around eggs subsequently injected into the lungs. The data suggest that the immunologic factors responsible for granuloma formation around *S. mansoni* and *S. japonicum* eggs may differ significantly.

7941 ANTIEOSINOPHIL SERUM AND THE KINETICS OF EOSINOPHILIA IN Schistosomiasis mansoni. *(E.)* Mahmoud, A. A. F.; Warren, K. S.; Graham, Jr., R. C. (Dept. Medicine, Case Western Reserve Univ., Cleveland, Ohio 44106). *J. Exp. Med.* 142(3):560-574, 1975.

Using a murine model of schistosomiasis, the most important helminth infection in man, the kinetics of eosinophilia in the peripheral blood, bone marrow, and tissue lesions were studied; this was followed by an examination of the effects of rabbit antimouse antieosinophil serum, developed in authors' laboratory, on these reactions. Groups of young adult female CF-1 mice were infected by s.c. injection of 10, 50, or 200 cercariae of the Puerto Rican strain of *Schistosoma mansoni* and the kinetics of peripheral blood and bone marrow eosinophilia were followed for as long as 20 weeks. When the schistosomula (immature worms) were migrating from the lungs to the liver there was a mild, transient eosinophilia, but soon after the onset of egg laying by the schistosomes, a major and prolonged increase in eosinophils occurred. This was terminated in the heavier infections by the death of the animals, but showed a spontaneous decline beginning at 18 week in the lightly infected mice. The effect of *S. mansoni* eggs on eosinophilia in the blood, bone marrow, and granulomatous lesions was then examined by injecting schistosome eggs into mice i.p., s.c., and i.v. While the host response was dependent on the route by which eggs were administered, primary peripheral and bone marrow responses were seen on i.v. injection, and secondary responses occurred on i.v. and s.c. injection. In unsensitized and egg-sensitized mice, eosinophils were first seen around eggs injected into the pulmonary microvasculature at 96 and 24 hr, resp. When the granulomas were maximal in size, eosinophils made up at least 50% of the lesions. Administration of rabbit antimouse antieosinophil serum profoundly suppressed eosinophils in the peripheral blood, eliminated mature eosinophils and markedly increased eosinophil precursors in the bone marrow, and ablated eosinophils from the tissue lesions, considerably reducing their area.

7942 COMPLICATING HYDATID CYSTS OF THE LIVER. *(Sp.)* Olsina, J.; Vidal Sans, J.; Gomez Conde, S.; Avila, F.; Rivero, L. (Francisco Franco Municipal Sanitarium Social Security, Barcelona, Spain). *Rev. Esp. Enferm. Appar. Dig.* 45(4):373-386, 1975.

7943 THERAPEUTIC ATTEMPT WITH DIFETARSONE IN TRICHURIASIS. *(Sp.)* Quevedo, W.; Plata Rueda, E.; Arciniegas, E. Q.; Gonzalez, M. (Faculty Medicine, Natl. Univ. Colombia, Bogota, Colombia). *Pediatria* 14(4):235-243, 1974.

7944 MEBENDAZOLE VALUE IN THE TREATMENT OF HELMINTHIASIS IN RURAL POPULATIONS. *(Por.)* Fernandes, P. (Instituto do Ciencias Biologicas de Universidade Federal do Rio Grande do Norte, Brazil). *Folia Med. (Plovdiv)* 69(3):301-302, 1974.

7945 TREATMENT OF INTESTINAL AMEBIASIS IN 24 HOURS WITH A NEW DOSAGE SCHEME OF TECLOZAN. *(Por.)* Fernandes, P.; Sant'Anna, I. B.; Lima, D. C. (Instituto de Ciencias Biologicas da Universidade Federal do Rio Grande do Norte, Brazil). *Folia Med. (Plovdiv)* 69(3):293-298, 1974.

7946 Echinococcus multilocularis CAUSING EXTENSIVE BILIARY OBSTRUCTION. *(Ger.)* Gunther, V. R.; Georgi, M.; Benken, U.; Kirschner, P. (Institut fur Klinische Strahlenkunde, Mainz, Germany). *Fortschr. Rontgenstr.* 122(3):242-244, 1975.

7947 INTEREST OF BIOPSY OF RECTAL MUCOSA FOR THE STUDY OF THE EPIDEMIOLOGY AND PATHOGENIC ACTION OF SCHISTOSOMIA. *(Fr.)* Bouvry, M.; Cape, Y. (Hopital de Cocody, B.P. 20632, Abidjan, Ivory Coast). *Ann. Gastroenterol. Hepatol.* 11(1): 37-42, 1975.

7948 PYOGENIC LIVER ABSCESSES: FOUR CASES. *(Fr.)* Mauuary, G.; Lorenzini, C.; Fays, J.; Zuck, P.; Ravey, M.; Duc, M. (no affiliation given). *Ann. Med. Nancy* 14:233-234, 237-238, 240, 1975.

7949 SURGICAL TREATMENT FOR SUPPURATIVE HEPATIC HYDATID ECHINOCOCCOSIS. *(Rus.)* Silaev, J. S.; Tretiakov, A. A. (Orenburg Medical Inst., Orenburg, USSR). *Vestn. Khir.* 114(4):33-36, 1975.

7950 BIOCHEMICAL DIAGNOSIS OF ASCARIASIS AND ITS SPECIFICITY. *(Pol.)* Pirog, Z.; Pietron, W. (Acad. Medicine, 20-080 Lublin, Dymitrowa 11, Poland). *Wiad. Parazytol.* 20(6):849-853, 1974.

7951 RESULTS OF INVESTIGATIONS ON THE OCCURRENCE OF INTESTINAL PARASITES IN THE TOWN AND THE (RURAL) DISTRICT OF RZESZOW. *(Pol.)* Glowniak, C.; Wisniewski, R. (Provincial Station Sanitation Epidemiology, 35-036 Rzeszow, Dabrowskiego 33 m. 17, Poland). *Wiad. Parazytol.* 20(6):855-864, 1974.

7952 INVESTIGATIONS ON THE OCCURRENCE OF Isospora hominis (RAILLIET AND LUCET, 1891) INFECTION AMONG THE RURAL POPULATION OF THE KOSZALIN PROVINCE. *(Pol.)* Plotkowiak, J. (Provincial Station Sanitation Epidemiology, 70-632 Szczecin, Spedytorska 6-7, Poland). *Wiad. Parazytol.* 20(6):865-872, 1974.

7953 CLINICAL COURSE AND MANAGEMENT OF HEPATIC ECHINOCOCCOSIS. *(Rus.)* Askerkhanov, R. P.; Makhatilov, M. M.; Saidov, G. S. (Dagestan Medical Inst., Makhachkala, USSR). *Khirurgiia (Mosk)* (1):50-56, 1975.

7954 PERICYSTOGASTROSTOMY IN THE TREATMENT OF SOME HYDATID CYSTS IN THE MIDDLE AND LEFT PARTS OF THE LIVER. *(Fr.)* Fagarasanu, I. (No affiliation given). *Bull. Soc. Int. Chir.* 33(5-6):503-506, 1974.

7955 PAPILLOTOMY AS AN ADJUNCT TO THE SURGICAL TREATMENT OF HYDATID CYSTS OF THE LIVER. *(Fr.)* Tagiacozzo, S.; Daniele, G. M. (Faculty Medicine, Cagliari, Italy). *Bull. Soc. Int. Chir.* 33(5-6):493-497, 1974.

7956 PLASMA PROTEINS IN KALA-AZAR: STUDY OF THE COURSE OF TWO CASES WITH IMMUNODIFFUSION TECHNIQUES. *(Sp.)* Cuartero, A. R.; Carril, J. N. (Dept. Internal Medicine, Univ. Granada, Granada, Spain). *Rev. Clin. Esp.* 134(5):467-472, 1975.

7957 SOME ORGAN INDICES OF THE HOST IN LARVAL ASCARIASIS. II. SPLEEN AND ADRENALS GUINEA PIGS EXPERIMENTALLY INFECTED WITH Ascaris lumbricoides suis. *(Pol.)* Zembrzuski, K. (PZH, 00-791 Warszawa, Chocimska 24, Poland). *Wiad. Parazytol.* 20(6):823-828, 1974.

7958 Fasciola hepatica INFESTATIONS IN THE HUMAN LIVER. *(Ger.)* Zeigler, K.; Osten, M.; Lafrenz, M.; Moller, F. W. (Bereichs Medizin, Univ. Rostock, Rostock, Germany). *Z. Gesamte Inn. Med.* 30(7):344-346, 1975.

7959 HEPATIC ECHINOCOCCOSIS WITH ALVEOLAR AND VESICULAR MIXED STRUCTURES. *(It.)* Romanelli, R. (Spedali Riuniti, Pistoia, Italy). *Pathologica* 66(957-958):295-303, 1974.

7960 HYPOTHESIS ON THE PHYLOGENY OF VERTEBRATE COCCIDIOMORPHA. *(Fr.)* Landau, I. (C.N.R.S., Paris, France). *Z. Parasitenkd.* 45:63-75, 1974.

7961 HYDATID CYST IN THE PANCREAS. *(Fr.)* Tissot, E.; Peschaud, R.; Vignal, J.; Francillon, J. (Hopital Ed.-Herriot, 69374 Lyon, France). *Lyon Chir.* 71(2):127-130, 1975.

7962 TOLERANCE TO AND ACTIVITY OF A SCHISTOSOMACIDE, A NEW DERIVATIVE OF THIAZOLYLIMIDAZOLE (26,354 R. P.): PRELIMINARY RESULTS. *(Fr.)* Gentilini, M.; Danis, M.; Niel, G.; Charmot, G. (Pitie-Salpetriere Group Hosp., Paris, France). *Bull. Soc. Pathol. Exot.* 67(5):516-522, 1974.

7963 TREATMENT OF INTESTINAL AMEBIASIS. *(Fr.)* Andre, L. J.; Condat, J. (Inst. Tropical Medicine, Marseille, France). *Med. Armees* 3(4):319-321, 1975.

7964 AMEBIASIS: PATHOGENETIC AND CLINICAL PROBLEMS. *(It.)* Argiolas, N.; Perpignano, G.; Berillo, A.; Pintus, A. (Istituto di Patologia Speciale Medica, Univ. delgli Studi di Cagliari, Cagliari, Italy). *Rass. Med. Sarda* 26(3):221-260, 1974.

7965 HEPATIC AMOEBIASIS: ACTUAL DIAGNOSTIC AND THERAPEUTIC ASPECTS. *(It.)* Perpignano, G.; Argiolas, N.; Pintus, A. (Istituto di Speciale Batologia Medica, Univ. di Cagliari, Cagliari, Italy). *Rass. Med. Sarda* 26(2):143-168, 1974.

7966 ON A CASE OF PROBABLE AMEBIC LIVER ABSCESS. *(It.)* Perpignano, G.; Argiolas, N.; Berillo, A. (Istituto di Patologia Speciale Medica, Univ. di Cagliari, Cagliari, Italy). *Rass. Med. Sarda* 26(2):111-120, 1974.

7967 AMEBIC ABSCESS OF THE LIVER: RETROSPECTIVE STUDY OF 125 PATIENTS. *(Sp.)* Dehesa, M.; Cario, A.; Wolpert, E. (Departamento de Gastroenterologia, Instituto Nacional de la Nutricion, Mexico 22, D. F.). *Rev. Invest. Clin.* 27(2):129-133, 1975.

7968 INVESTIGATION OF MICROCIRCULATION IN THE GASTRIC WALL OF THE ALBINO RAT BY THE METHOD OF VITAL MICROSCOPY. *(Rus.)* Lakhtima, V. P.; Kozlov, V. I. (Dept. Hospital Surgery, Pirogov Second Medical Inst., Moscow, USSR). *Arkhiv. Anat. Gistol. Embriol.* 68(5):61-66, 1975.

7969 TOPOGRAPHIC SYNDROMES OF AMEBIC ABSCESSES OF THE LIVER. *(E.)* Munabe, K. K.; Muanza, D.; Mutamba, M.; Wierzbicki, J. (Dept. Surgery, Univercite National du Zaire, Republic of Zaire). *Mater. Med. Pol.* 7(1):41-46, 1975.

7970 Trypanosoma rhodesiense: FOLATE LEVELS IN SERA AND TISSUES OF NORMAL AND FOLIC ACID-DEFICIENT RATS. *(E.)* Aboko-Cole, G. F.; Lee, C. M. (Dept. Zoology, Howard Univ., Washington, D.C. 20001). *Z. Parasitenkd.* 45(3):281-290, 1975.

7971 THE DEVELOPMENT OF THE PRIMITIVE EPITHELIUM AND TRUE TEGUMENT IN THE CERCARIA OF Schistosoma mansoni. *(E.)* Meuleman, E. A.; Holzmann, P. J. (Dept. Medical Microbiology and Parasitology, Free Univ., Amsterdam, Netherlands). *Z. Parasitenkd.* 45(4):307-318, 1975.

See also, 6984, 7006, 7059, 7383, 7513, 7920.

## GENERAL

### Regional Enteritis

7972 CROHN'S DISEASE IN A DEFINED POPULATION: AN EPIDEMIOLOGICAL STUDY OF INCIDENCE, PREVALENCE, MORTALITY, AND SECULAR TRENDS IN THE CITY OF MALMO, SWEDEN. *(E.)* Brahme, F.; Lindstrom, C.; Wenckert, A. (Malmo General Hosp., Malmo, Sweden). *Gastroenterology* 69(2):342-351, 1975.

A prospective epidemiological study of Crohn's disease in Malmo, Sweden, was carried out between 1958 and 1973. Case records were obtained from the single general hospital in the city; all cases met histological and/or radiological criteria for Crohn's disease. All cases of chronic ulcerative colitis were studied for comparative purposes. The mean annual incidence rate for new cases of Crohn's disease was $4.8/10^5$ inhibitants ($4.6/10^5$ for males and $5.1/10^5$ for females). The recorded incidence rates increased from $3.5/10^5$ during the first 8 yr to $6.0/10^5$ during the last 8 yr, the maximum annual incidence rate ($8.3/10^5$) being recorded in 1971. The ratio of small bowel to large bowel Crohn's disease remained at approximately 1.6 throughout the study period, the annual incidence rates of both types increasing during the last 8 yr. The mean annual incidence rate for ulcerative colitis was $6.4/10^5$ population. The median age at onset of Crohn's disease was 22 yr, and less than 6% of the patients were more than 50 yr at the time of onset. The age distribution for ulcerative colitis was similar to that of Crohn's disease. In 6 families, more than 1 first degree relative was afflicted with Crohn's disease, and the incidence rate among members of the Jewish population was 5-fold higher than in the non-Jewish population. The prevalence rates for Crohn's disease on December 21, 1965 and December 31, 1973 were 20.9 and 75.2 per $10^5$ population, respectively; the prevalence rate for ulcerative colitis on December 31, 1968 was 89 per $10^5$ population. During the 16-yr study period, 3.1% of the Crohn's disease patients died, the annual death rate from Crohn's disease being 0.15 per $10^5$ population. The annual death rate from ulcerative colitis was 0.4 per $10^5$ population. It is likely that an actual increase in the occurrence of Crohn's disease took place in Malmo during the time period studied.

7973 CROHN'S DISEASE AND PREGNANCY. *(E.)* Martimbeau, P. W.; Welch, J. S.; Weiland, L. H. (Mayo Clinic, 200 First St., SW, Rochester, Minnesota 55901). *Am. J. Obstet. Gynecol.* 122(6):746-749, 1975.

The relation between Crohn's disease and pregnancy was studied in two women clinically, and eight cases were reviewed in the literature, in which the disease commenced during pregnancy. A 34-yr-old woman presented during the sixth month of pregnancy with pain in the left upper quadrant and weight loss. There was a two-month history of moderate epigastric pain. She was found to have microcytic anemia. About a month later, a soft mass, 4 x 6 cm, was found between the epigastric area and left upper quadrant. It was tender, close to the anterior abdominal wall, and movable. She became febrile, signs of peritonitis appeared, and laparotomy was performed. The mass was a localized inflammatory process with adherence and involvement of the terminal ileum, cecum, ascending colon, and transverse colon. Right hemicolectomy with end-to-end ileotransverse colostomy was performed. Pathology confirmed advanced active regional enteritis. Spontaneous labor occurred 32 hr later, and an infant (Apgar score 7) was delivered and survived for 7 hr. The disease later recurred but remained quiescent. The second case involved a 34-yr-old woman who presented with diarrhea during the sixth month of pregnancy. The pregnancy was normal, but the diarrhea persisted after delivery. Roentgenograms showed Crohn's disease of the terminal ileum, which was brought under control with drugs and rest. Of the total of 10 cases in which Crohn's disease became symptomatic during pregnancy, six required surgery during or immediately after pregnancy. One died postoperatively. Of 11 fetuses, five lived (including a pair of twins). It is concluded that a generally favorable relation exists between Crohn's disease and pregnancy, but when active disease commences during pregnancy there is an increased risk to mother and fetus.

7974 A CASE OF 'CROHN'S CARCINOMA'. *(E.)* Fleming, K. A.; Pollock, A. C. (Glasgow Royal Infirmary, Scotland). *Gut* 16(7):533-537, 1975.

A case of adenocarcinoma of the ileum, occurring in an area concomitantly the site of Crohn's disease, is described. A 55-yr-old woman presented with a 4-week history of right-sided abdominal pain, nausea, vomiting, and weight loss. A tender mass in the right iliac fossa was provisionally diagnosed as an appendix mass; it slowly resolved during the subsequent 9 mo. A narrowed area in the terminal ileum remained unchanged, but the patient was free of symptoms. When the symptoms returned a yr later, a laparotomy was performed. The appearances were those of Crohn's disease of the terminal ileum in a quiescent phase and the affected portion of ileum and part of the cecum and ascending colon were removed, with end-to-end anastomosis of the ileum and colon. The patient recovered uneventfully and has remained well. Carcinoma was not suspected at operation or on macroscopic examination of the operative specimen. However, on microscopic examination, a moderately well-differentiated adenocarcinoma of the ileum arising in an area of Crohn's disease, with dysplastic surface epithelium was observed. Examination of the literature suggests that there are certain characteristics of the small bowel carcinoma which are found in Crohn's disease. These include invisibility of the tumor on macroscopic examination, dysplasia in the surrounding mucosa, and a peculiar endometriosis-like pattern of invasion. It is concluded that 'Crohn's carcinoma' is sufficiently different from carcinoma de novo to indicate that it is a definite complication of Crohn's disease of the small bowel. This possibility should be considered in any Crohn's disease patient who shows a sudden deterioration in condition.

7975 A SEARCH FOR A TRANSMISSIBLE AGENT IN CROHN'S DISEASE. *(E.)* Heatley, R. V.; Bolton, P. M.; Owen, E.; Williams, W. J.; Hughes, L. E. (Welsh Natl. Sch. Medicine, Cardiff, Wales). *Gut* 16(7):528-532, 1975.

To determine whether a transmissible agent might be responsible for Crohn's disease, homogenates of diseased human bowel from patients undergoing intestinal resection for Crohn's disease were repeatedly inoculated into the hind footpads or terminal ileums of Wistar rats, TO mice, and New Zealand white rabbits. In the rabbits, homogenates from one patient were injected into multiple sites in the terminal ileum and homogenates from another patient were injected into multiple sites in the appendix. Prior to inoculation of the homogenates, some rats underwent regional lymphadenectomy and ligation of the draining lymph trunk, and in some rats, the homogenate was instilled *via* nasogastric tube into the stomach. Except for the changes attributable to lymphedema and surgery, no macroscopic evidence of abnormality was seen in any of the animals. In addition, no sarcoid-like granulomas were found in any biopsy specimen of terminal ileum, colon, mesenteric lymph node, liver, or spleen. Of 56 ileums injected with Crohn's or control homogenates, only five showed evidence of mucosal inflammation; deposits of amyloid were also found in the villi of two mice injected with control homogenates. Of 19 injected rat footpads, six showed evidence of chronic inflammation. The results of all microbiological examinations were negative. The data indicate that it is unlikely that a transmissible agent is universally present in Crohn's disease and that it is therefore unlikely that such an agent has a significant role in the pathogenesis of this disease.

7976 VASCULAR PATTERN IN ILEAL CROHN'S DISEASE. *(E.)* Kalima, T. V.; Peltokallio, P.; Myllarniemi, H. (Univ. Central Hosp., Haartmaninukatu 4 00290 Helsinki 29, Finland). *Ann. Clin. Res.* 7(1):23-31, 1975.

Angio-, micro-, and histoangiographic studies were made of the vascular changes in Crohn's disease. Five patients with ileal Crohn's disease of at least three month's duration in the chronic phase were used. All cases were confirmed at laparotomy, and all had at least one ileal stricture. During surgery, one, two, or three mesenteric arteries were cannulated, and after resection contrast medium was injected into them. Continuous perfusion was maintained for four to six hr and x-rays were taken. For microangiography, specimens were fixed in formalin and cut into 3-5 mm slices. For histoangiography, specimens

were sectioned at 5, 20, and 150 μ. The ileal vascular pattern was abnormal, but consistent in all patients. The long vasa recta branched normally from the marginal arcades, but the distances between them were much narrower than normal. Their number was increased three to five times per unit length of ileum and they were narrower by 30-50% in affected areas than unaffected areas. The angles between the anterior and posterior branches of the long vasa recta where the mesentery is thickened were wider than normal. The short vasa recta were also increased in number. The micro- and histoangiographic studies showed the submucosal vascular complex to be well-developed and more prominent than in the normal ileum. In the typical enlarged villi the small arteries were wider than normal, but the vascular architecture was essentially normal. It is concluded that selective mesenteric angiography may be useful in diagnosis of Crohn's disease, and in estimation of its extent.

7977 SEMIMACROSCOPIC EXAMINATION OF THE SURFACE PATTERN OF SMALL INTESTINAL MUCOSA IN CROHN'S DISEASE. *(E.)* Poulsen, S. S.; Nielsen, O. V.; Fabricius-Lauritzen, K. E. (Medicinsk-anatomisk institut B, Nørre Allé 63, DK-2100 Copenhagen ϕ, Denmark). *Acta Pathol. Microbiol Scand* [A] 83(4):379-388, 1975.

A semimacroscopic examination was performed, using stained whole mounts, of the small intestine in Crohn's disease. Six patients, aged 16 to 30 years, were used. The main symptoms were pain, diarrhea and weight loss. In four of six patients, a palpable intra-abdominal mass, along with internal or *in ano* fistuals, was present. There were marked changes in villus appearance. These changes ranged from slightly enlarged, thick, short, club-shaped villi in the apical region to greatly enlarged, densely packed villi. The polypoid structures varied in size, were assembled in rows separated by narrow fissures and were avillous. Ulcerations were mostly flat-bottomed, sharply demarcated, irregular and usually confluent. Histological sections showed the villi with centrally located, dilated lymphatics in the early stages, followed progressively by edema and inflammation. All specimens showed changes described as being typical of Crohn's disease and satisfied the common histopathological criteria for this disease.

7978 SERUM LYMPHOCYTOTOXINS IN INFLAMMATORY BOWEL DISEASE. STUDIES OF FREQUENCY AND SPECIFICITY FOR LYMPHOCYTE SUBPOPULATIONS. *(E.)* Strickland, R. G.; Friedler, E. M.; Henderson, C. A.; Wilson, I. D.; Williams, Jr., R. C. (Univ. New Mexico Sch. Medicine, Albuquerque, N. M. 87131). *Clin. Exp. Immunol.* 21(3):384-393, 1975.

The relative T- or B-cell specificity of lymphocytotoxic antibodies occurring in the sera of patients with inflammatory bowel disease was examined. In addition, a preliminary attempt was made to examine the possible T-cell subpopulation specificities using T lymphocyte-enriched target cell preparations from patients with common variable immunodeficiency. Serum cold-reactive lymphocytotoxin (LCT) was detected in 23/56 (40%) patients with inflammatory bowel disease (IBD). The frequency of LCT detection was similar in Crohn's disease of either the small bowel or colon (43 of 56 patients studied) and ulcerative colitis (13/56 patients). Cytotoxicity testing against T or B cell-enriched peripheral blood lymphocytes from normal donors, together with absorption experiments, indicated that lymphocytotoxin in inflammatory bowel disease was reactive against determinants on both cell subpopulations. Reactivity against T cells from patients with common variable immunodeficiency was significantly less than with normal donor T cells. Lymphocytotoxin in inflammatory bowel disease could not be related to prior allogenic sensitization and its presence appeared to be unrelated to disease activity or drug therapy. No correlation was found between LCT and peripheral blood T- or B-cell numbers. The present findings suggest that the need for further investigation of the role of infectious agents in the pathogenesis of inflammatory bowel disease.

7979 THE IMMUNE RESPONSE TO ϕX 174 IN MAN. II. PRIMARY AND SECONDARY ANTIBODY PRODUCTION IN PATIENTS WITH CROHN'S DISEASE. *(E.)* Bucknall, R. C.; Jones, J. V.; Peacock, D. B. (Frenchay Hosp., Bristol, England). *Am. J. Dig. Dis.* 20(5):430-436, 1975.

A study was conducted of the ability of patients with Crohn's disease to develop a primary and secondary antibody response to a standard antigen. Ten patients in various stages of Crohn's disease were injected with $3.3 \times 10^9$ plaque-forming units of the bacteriophage ϕX 174. A further 5 patients with Crohn's disease were tested for the presence of preimmunization antibodies to ϕX 174. In 1 patient, antibody was present in the serum at a titer of 270 before immunization. None of the remaining patients had detectable preimmunization antibody. A normal primary response to the first injection of bacteriophage occurred in 9 patients. The one patient with detectable preimmunization antibody developed an IgG (secondary) response to the first injection of antigen. Apart from that one patient, primary responses are within the range of normal subjects for time of appearance of antibody, rate of increase of antibody titers, height and time of peak response, and rate of antibody decline. The same patient who showed antibody prior to injection showed no increase in antibody titer after the second injection of bacteriophage. The 9 remaining patients showed a secondary antibody response within the normal range in all parameters. The normal response to the bacteriophage in these 9 patients showed that the impaired cellular immunity found in Crohn's disease is not associated with depression of antibody production. It is suggested that the abnormal response in the one patient may be due to a defect in the local (IgA) immune mechanism in the gut, which would allow the bacteriophage to enter the circulation, or to the proliferation of bacteriophage in an abnormal environment. There was no correlation with gut surgery or with clinical activity. The results of this study allow

the conclusion that there is no evidence of impaired capacity for antibody production in Crohn's disease.

7980 REOPERATION AND RECURRENCE IN CROHN'S COLITIS AND ILEOCOLITIS: CRUDE AND CUMULATIVE RATES. *(Eng.)* Greenstein, A. J.; Sachar, D. B.; Pasternack, B. S.; Janowitz, H. D. (Mount Sinai Sch. Medicine, City Univ. New York, New York, N.Y. 10029). *N. Engl. J. Med.* 293(14):685-690, 1975.

Follow-up data from crude and actuarial (life-table) methods of 160 patients (mean age, 24 yr) hospitalized with Crohn's colitis (30 patients) or ileocolitis (130) from 1964-1973 were analyzed to determine the risk of recurrence. Of a total of 100 patients who underwent major operation (65% with ileocolitis and 50% with Crohn's disease), 58 (63%) required reoperation. There was a cumulative reoperation rate of 89 by the 15th yr after the initial operation and an overall clinical recurrence of 94%. Crude data indicate that the reoperation rate diminished with each succeeding operative procedure; 58% to 47% from the first to the fourth operation. By contrast, actuarial analysis revealed that at the 3-yr follow-up point, the cumulative chance of reoperation increased from 37% to 60% for the first to the fourth operation. The crude reoperation rate was higher after bypass than after resection, indicating residual disease after bypass procedures. It is concluded that the evaluation of clinical or operative procedures by crude recurrence rates is misleading, as it fails to account for differing length of follow-up study. The authors also suggest a re-evaluation of the literature and more rigid definition of the disease and of a true recurrence.

7981 A CONTROLLED TRIAL OF AZATHIOPRINE IN CROHN'S DISEASE. *(E.)* Rosenberg, J. L.; Levin, B.; Wall, A. J.; Kirsner, J. B. (Dept. Med., Univ. Chicago, 950 East 59 St., Chicago, Ill. 60637). *Am. J. Dig. Dis.* 20(8):721-726, 1975.

The present trial was undertaken to determine if the steroid-sparing properties may be attributed to azathioprine in the treatment of Crohn's disease and to assess the effects of this agent on the clinical course of patients with Crohn's disease who appear to require steroids for the control of symptoms. A group of 20 patients (nine female and 11 male, age range 15-56 yr) with Crohn's disease of the small intestine or small intestine and colon, requiring at least 10 mg prednisone/day over the three months prior to entering the study, were randomized into placebo (10 patients) and azathioprine (10 patients; 2.0 mg/kg/day) treatment groups, and followed thereafter for 26 weeks. Of every 10 patients entering the study, half were in each group. Prior to and on completion of the study each patient had a complete blood count, platelet count, serum iron and iron-binding capacity, serum protein electrophoresis, liver function tests, and complete x-rays of the gastrointestinal tract. Patients were interviewed in clinic or by telephone at least every two weeks of the trial and questioned specifically about diarrhea, pain, malaise, weight loss, and fever. Reduction of steroids was the major criterion of success in the trial. There were seven relapses in the placebo group (five patients) and two relapses in the azathioprine group (2 patients). Complications including fistulae were not affected by the medications. The mean reduction in steroid dosage in the azathioprine group at the end of the trial (-15.5 mg) was greater than in the placebo group (-6.1 mg). These results suggest that azathioprine may permit reduction or discontinuation of steroids without worsening of symptoms in some patients who appear to require steroids for control of their symptoms. The clinical features of this "azathioprine-responsive subgroup" remain to be defined.

7982 THE EFFECT OF THE SITE OF LESION AND EXTENT OF RESECTION IN DUODENAL BILE ACID CONCENTRATION AND VITAMIN $B_{12}$ ABSORPTION IN CROHN'S DISEASE. *(E.)* Lenz, K. (Rigshospitalet, Blegdamsvej 9, 2100, Copenhagen, Denmark). *Scand. J. Gastroenterol.* 10(3): 241-248, 1975.

Duodenal bile acid concentrations following a standard meal, the glycine/taurine (G/T) ratio, vitamin $B_{12}$ absorption, and fecal fat were determined in 70 patients with Crohn's disease. Jejunal resection had been performed in four patients and ileal resection in 46; of these 50 patients, five also had a cecal resection, 23 a hemicolectomy, and nine a subtotal or total colectomy. Two had an ileorectal anastomosis and 11 an ileostomy. Active disease was present only in 10 of the 29 unoperated patients. Almost all of 29 patients subjected to ileal resection of 50 cm or more had a reduced bile acid concentration and vitamin $B_{12}$ malabsorption. The degree of vitamin $B_{12}$ malabsorption showed a better correlation ($P < 0.001$) with the length of ileal resection than did the duodenal bile acid concentration ($P < 0.05$). Patients with small ileal resections (10-50 cm) and unoperated patients did not show a consistent pattern; however, 10 of 17 with limited resection had decreased bile acid concentrations and seven had vitamin $B_{12}$ malabsorption. A comparison in 68 patients (operated and unoperated) showed that postprandial duodenal bile acid concentration and vitamin $B_{12}$ absorption are equally efficient as indicators of ileal dysfunction; both were decreased in about half the cases. This pattern was not seen in ileostomy patients in whom duodenal bile acid concentration decreased in every case, while vitamin $B_{12}$ malabsorption occurred only in those with large ileal resections (80 cm or more). The G/T ratio was elevated only in patients with large resections and the elevation was not related to the presence of abnormal duodenal flora. Fecal fat was much more elevated in ileostomy patients with large ileal resections than in unoperated patients and those without an ileostomy. In addition to demonstrating a close correlation between vitamin $B_{12}$ malabsorption and the extent of ileal resection, this study supports the importance of colonic bile acid absorption in patients with ileal dysfunction.

7983 THE ROLE OF COLONOSCOPY IN THE DIFFERENTIAL DIAGNOSIS OF INFLAMMATORY BOWEL DISEASE [abstract]. *(E.)* Waye, J. D. (Mt. Sinai Sch. Med., New York, N. Y.). *Gastroenterology* 68(4):1050, 1975.

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7991 FREQUENCY AND NATURE OF CIRCULATING LYMPHOCYTOTOXINS (LCT) IN INFLAMMATORY BOWEL DISEASE (IBD). *(E.)* Strickland, R. G.; Henderson, C. A.; Frideler, E. M.; Williams, Jr., R. C. (Univ. New Mexico Sch. Med., Albuquerque, N.M.). *Gastroenterology* 68(4):993, 1975.

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See also, 7001, 7296, 7434, 7447, 7471, 7494, 7498, 7511, 7847, 7920.

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